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ABSTRACT

Using multiple regression analysis for each county and a case study of selected services in Johnson County, Iowa, the study estimated the impacts of rural non-farm development in Iowa on the demand for local public services, on the cost of providing these services, and on the distribution of service benefits and tax burdens among population groups. The rural non-farm population of each county was calculated by subtracting from the total population living in each incorporated city and town and the approximate rural farm population. Predictive findings were revealed in five areas of local public services: (1) lower per capita expenditures on county secondary roads in low rural development areas; (2) higher rural crime rates and higher per capita sheriff's expenditures in high rate rural non-farm development areas; (3) increased school busing and construction costs in fringe areas; (4) no likely substantial impacts on services such as water, sewer, solid waste disposal and fire protection; and (5) unaffected costs in the areas of health, welfare and social services due to the location of county residents served. Impacts were minimized in all areas whenever there was a close coincidence between the group of households benefitting from a service and the group paying the costs; therefore, recommendations were to force development in ways that could eventually be self-supporting. (JD)

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# THE IMPACT OF RURAL NON-FARM RESIDENTIAL DEVELOPMENT ON THE PROVISION OF LOCAL PUBLIC SERVICES

Peter S. Fisher

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THE LEGISLATIVE ENVIRONMENTAL ADVISORY GROUP

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# THE IMPACT OF RURAL NON-FARM RESIDENTIAL DEVELOPMENT ON THE PROVISION OF LOCAL PUBLIC SERVICES

Peter S. Fisher

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## PREFACE

The Ford Foundation Program in Policy Analysis for State Environmental Management is providing support for land use research in Iowa. This program is designed to increase involvement of college and university researchers in public policy research.

In Iowa, the Legislative Environmental Advisory Group (LEAG), consisting of legislators, university faculty and representatives from state agencies and local government associations, was formed to: 1) foster dialogue between policy makers and researchers, 2) solicit and fund college and university based research projects related to land use in Iowa, and 3) transmit research results and technical analyses to all members of the Iowa General Assembly.

Under the direction of LEAG, the Institute of Urban and Regional Research, University of Iowa, solicited research proposals and, as a result of this solicitation, six research projects were completed in 1978. The purpose of these projects is to provide background information and technical analyses to better understand the effects of existing or proposed policies. Project reports are now available for distribution and are listed on the back page of this report.

Kenneth J. Dueker, Director
Institute of Urban and
Regional Research

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Bi-State Metropolitan Planning Commission

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Metropolitan Area Planning Agency

Northwest Iowa Regional Council of Governments

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# THE IMPACT OF RURAL NON-FARM RESIDENTIAL DEVELOPMENT ON THE PROVISION OF LOCAL PUBLIC SERVICES

## Executive Summary

The past fifteen years have witnessed a significant increase in non-farm residential development in unincorporated rural areas of Iowa. As more and more Iowans choose rural homesites, the provision of local public services may be affected. Non-farm residents may demand more or different services; development may alter the per-unit cost of providing services; and the distribution of benefits and tax burdens may become less equitable. This study provides a preliminary assessment of the impacts of rural non-farm development in Iowa on the provision of public services by counties, special districts, and homeowners' associations.

The rural non-farm population has been the fastest-growing segment of the Iowa population at least since 1960. Using U.S. Census data, Census estimates, and other information, we were able to estimate the rural non-farm population for each Iowa county for 1960, 1970, and 1976. While the urban population has been increasing slowly, and the farm population has been declining, the rural non-farm population increased about 25% from 1960 to 1970 and another 32% from 1970 to 1976. In 1960, non-farm residents accounted for about 22% of the population of unincorporated areas. By 1970 this share had risen to about 32%, and by 1976 it reached 41%. In seventeen counties, the non-farm share exceeded 50% in 1976, and in another 40 counties the proportion was between 30% and 50%.

The conclusions of this study with regard to the impacts of this rural non-farm development on local public service demands and costs can be summarized as follows:

(1) In the short run, at least, and for lower levels of rural development, it appears that non-farm development may lower per capita expenditures on county secondary roads. That is, maintenance expenditures increase less rapidly than population. However, this does not mean that non-farm development has a beneficial effect on the provision of roads. First, the lower per capita expenditures may reflect deteriorating quality of service rather than lower costs. Second, this may be only a short-run phenomenon. More concentrated development could push traffic volumes on certain roads over the threshold level, so that gravel roads will need to be oiled (greatly increasing maintenance costs) or hard-surfaced (necessitating large initial construction costs). Third, if much rural development were re-directed into urban areas, the net effect on road expenditures in both rural and urban areas could be positive.

(2) There is some evidence (though it is not conclusive) that higher rates of rural non-farm development are associated with higher rural crime rates and higher per capita Sheriff's expenditures.

(3) The dispersal of population into rural areas will increase school bussing costs. Depending on where school district boundaries are drawn, there could also be a substantial impact on school construction costs. That is, schools in developing fringe areas may have to be enlarged at the same time that central city schools are becoming underutilized and may have to be closed.

(4) Impacts on other services such as water, sewer, solid waste disposal, and fire protection are not likely to be substantial. Water

and sewer service in rural areas is generally privately provided except in areas served by a rural water association. The resident bears the major cost of transporting solid waste to the landfill in the vast majority of counties. Rural fire districts will generally feel little impact on costs as a result of new development, provided rural subdivisions are not so large and concentrated as to require an additional fire house.

(5) A variety of services in the general area of health, welfare, and social services are generally provided to people in such a way that costs are unaffected by the location of the county residents served. This broad category of expenditures accounts for a large share of county government spending.

The impact of non-farm development on public service expenditures, and on the distribution of the tax burden among population groups, depends crucially on the location of that development and the geographic boundaries of the unit providing the particular service. Impacts are minimized whenever there is a close coincidence between the group of households benefitting from a service and the group paying the costs. For this reason, it would appear at first glance that homeowners' associations and special districts are, in some respects, the ideal vehicles for providing those services with a very localized and identifiable group of beneficiaries. These would include water distribution systems, sewer collector systems and sewage treatment plants, local streets, fire protection, and trash collection.

If increased development raises the cost of providing one of these services, by necessitating sewage treatment for example, there will be no fiscal impact on existing rural residents or neighboring cities if this increased cost is borne entirely by the new development responsible. This will be the case if the service is provided by a homeowners' association or a special district. If non-farm residents were forced to pay a larger

share of the full costs associated with their residential location choice (including any environmental costs), there would be less need for public concern regarding development patterns.

There are several problems with homeowners' associations. First, they are at a financial disadvantage in that intergovernmental grants are not available and there is no commercial and industrial tax base. All expenses must be financed by membership dues or fees. Second, they are not in a position to issue debt for the financing of large capital expenditures. This can lead to construction of inferior low-cost private roads; maintenance costs become burdensome and there may be demands for the county to take over the roads. Third, the boundaries are fixed and limited to a particular subdivision.

Special districts have definite financing advantages in that they can levy taxes and issue debt, though they may experience difficulty in selling bonds. They also are not constrained by pre-determined boundaries; district boundaries can be drawn to include a population large enough to support a service at a reasonable per capita cost. This can be important if a large initial capital outlay is required.

Despite the advantages of special districts, there are serious drawbacks. First, a proliferation of governments can hinder coordinated decision-making and planning and confuse voters as to the public officials responsible for different services. Second, it may not be desirable to grant a special district the authority to plan and build service infrastructures (such as water and sewer systems) without at the same time having any control over land use, which can be profoundly affected by that infrastructure. Third, the establishment of special districts

in unincorporated urban fringe areas may be an impediment to annexation, and annexation may well be the more desirable long-run solution.

Since this report has focused exclusively on the public service impacts of rural non-farm development, it would not be appropriate to draw any conclusions regarding land use policy. The environmental and social impacts of development may be quite significant, and an analysis of such impacts may well point to different kinds of policies. Nonetheless, it appears safe to say that if one were to consider only public service costs, impacts could be minimized through either of two policies: (1) Force development to occur at very low densities and in scattered locations so as to minimize any effects on costs; (2) Force development into a small number of designated areas at high densities, so that the development could eventually be self-supporting. Special districts, urban service districts, or homeowners' associations could provide services in the short run, with ultimate incorporation the goal.

These two policies could, in fact, be combined. For example, one residence per quarter/quarter section (40 acres) would be permitted; development at any higher density would require platting as a subdivision and would be subject to county approval and subdivision regulations. The object would be to avoid a land use pattern in which a large number of subdivisions of moderate density is scattered over the rural area. Such subdivisions could be substantial enough to have a sizeable impact on costs such as road improvements, school bussing, and police, but not concentrated enough to warrant incorporation as a city or formation of special districts. The cost increases would be shared by all county taxpayers.

The precise impacts of rural non-farm development will depend crucially on the particulars of the situation--the location and density

of the development, the current school capacities, the condition of and current traffic levels on public roads, etc. Local governments thus need to exhibit considerable flexibility in dealing with rural development. Further investigation would appear warranted to identify any constraints on the ability of local governments to deal effectively with the provision of services to rural non-farm residences and with the control of land use. Some possible examples are: (a) prohibition of formation of new fire districts, (b) impediments to a more equitable assessment of school bussing costs, (c) inability of county supervisors to employ special assessment powers for financing road improvements, (d) constraints on ability of homeowners' associations to pay for and receive county services at a higher level than that provided county-wide.

In addition to removing constraints such as those identified above, state policy should also be directed at the removal of any incentives embedded in existing state law which encourage the dispersal of population from urban to rural areas. Although the control of land use may best be left to local government, the state should at least avoid subsidizing sprawl or otherwise contributing to local land use problems. An example may be the use-value assessment of farm land (in the absence of a workable rollback provision), which can amount to a subsidy to land speculators and a stimulus to leap-frog development in urban fringe areas. Further investigation of this area may also be needed.

# THE IMPACT OF RURAL NON-FARM RESIDENTIAL DEVELOPMENT ON THE PROVISION OF LOCAL PUBLIC SERVICES

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# I. INTRODUCTION

At the broadest level, this study is concerned with the extent to which public service provision and financing is affected by changes in the spatial pattern of residential development. Most previous research in this area has focused on the issue of "urban sprawl," and has been primarily concerned with the public service costs of cities and how they are affected by dispersed development patterns within or close to the city boundaries. We have chosen instead to focus on residential development outside of cities and towns and the impacts of such development on service provision by non-urban governments (counties and special districts) and quasi-governments (homeowners' associations).

## The Problem

The past fifteen years have witnessed a significant increase in non-farm residential development in unincorporated rural areas of Iowa. While the urban population has been increasing slowly, and the farm population has been declining, the rural non-farm population increased about 25% from 1960 to 1970 and another 32% from 1970 to 1976.

The construction of residences on or near farm land is thought to cause a variety of problems: (1) prime agricultural land may be taken out of production; (2) supplies of ground water may be inadequate for dense development; (3) water quality may be threatened by use of private septic tanks; (4) a variety of other environmental and aesthetic effects may occur depending on the site; (5) scattered development encourages energy

consumption; (6) rural character and life-style may be altered permanently; (7) non-farm residents may view farm activities as a nuisance, and vice versa; (8) rural services may be inadequate for non-farm settlements, while provision of services characteristic of urban areas may be prohibitively expensive; (9) conflicts may develop over the provision of public services due to different needs and tastes of farmers and non-farmers; (10) the present system of financing local governments may result in significant inequities among farmers, non-farm rural residents, and urban residents.

This report focuses on the last three problems -- those relating to local public services. Rural non-farm development can have three kinds of impacts on public service provision:

(1) Non-farm residents may be employed in a city in an occupation unrelated to agriculture; they may have different backgrounds, education, and income than farmers; and they may be accustomed to a quality and range of public services typically found only in urban areas. For these and other reasons, non-farm residents may demand different kinds and amounts of public services than those desired by the farm and farm-related population.

(2) A substantial increase in the rural non-farm population may alter the per-unit cost of providing public services.

(3) An increase in rural non-farm residential development is likely to lead to changes in public services and in the costs of providing them, and therefore to changes in local government expenditures and tax rates. Farmers may end up subsidizing some of the services required by new non-farm residents, or vice versa. Similar changes in the distribution of the benefits and costs of local government

services may occur between the rural non-farm population and urban residents, especially where an urban school district encompasses large rural areas or where rural residents commute to a city.

## Purpose of this Study

The purpose of this study is to make some preliminary estimates of the impacts of rural non-farm development in Iowa on the demand for local public services, on the cost of providing these services, and on the distribution of service benefits and tax burdens among population groups. This information will then provide the basis for recommendations regarding state policy in the areas of land use regulation and local government finance.

## Previous Research

Most previous research in this area has fallen into one of three categories:

(1) Attempts to estimate statistically the cost of providing local public services.

(2) Fiscal impact studies of proposed new developments.

(3) Engineering cost estimates of providing particular services.

The focus of the vast majority of research has been urban rather than rural. Many economists have attempted to estimate the effect of differences in per capita income, population density, and other factors on local government expenditures. These studies have generally been based on larger-city data, and are of little use in projecting service costs in rural areas. Most fiscal impact studies have been directed at determining the effects of fringe development, new shopping centers, industrial parks, or annexation on the revenues or expenditures of a city. Again, very

little has been done of direct applicability to rural public services in Iowa. Finally, engineering cost estimates are available to a limited extent for certain rural services (sewer systems, water systems, streets etc.) and may be of some use.

General Methodology

Two approaches are employed. First, for certain services provided by county governments, a statistical analysis is performed using data for each county in Iowa. The purpose is to identify the extent to which higher per capita expenditures can be attributed to more extensive rural non-farm development. The method used is multiple regression analysis, enabling us to control for county differences in per capita income and general population growth or decline. This methodology is detailed in the Appendix, Part B.

The second approach consists of a case study of selected services in Johnson County, Iowa. The data consist of a variety of information on budgets, service levels, school enrollments and capacity, and service costs, taxes, and property values provided by local government officials.

## II. FINDINGS

### A. The Extent of Rural Non-farm Development

Since this study focuses on development occurring outside of incorporated areas, we were unable to use the U.S. Census definition of the rural non-farm population. The census defines rural non-farm to include those residing in towns with a population of 2500 or less. Instead, we defined "rural" as the unincorporated area of each county and calculated the rural population of each county for 1960, 1970, and 1976 by subtracting from total county population the population living within each incorporated city and town. From this number was subtracted the approximate rural farm population to obtain the rural non-farm population. (See Appendix A, p. 49-51 for the definition of "farm" and for the method used to estimate the 1976 farm population. It is noted there that the definitions result in conservative (low) estimates of the rural non-farm population).

Table 1

Population Change in Iowa, 1960-1976

| | Population | | | Percentage Change | |
|---|---|---|---|---|---|
| | 1960 | 1970 | 1976 | 1960-70 | 1970-76 |
| Large Cities | 1,460,528 | 1,605,788 | 1,634,680 | +9.9% | +1.8% |
| Small Cities | 444,399 | 469,649 | 474,546 | +5.7% | +1.0% |
| Unincorporated | 852,640 | 749,926 | 764,879 | -12.0% | +2.0% |
| Rural Farm | 662,239 | 512,301 | 452,194 | -22.6% | -11.7% |
| Rural Non-farm | 190,401 | 237,625 | 312,685 | +24.8% | +31.6% |
| TOTAL STATE | 2,757,537 | 2,825,368 | 2,874,105 | +2.5% | +1.7% |

Note: See Appendix, Part A, for data sources, definitions, and computation procedures.

As Table 1 indicates, the rural non-farm population has been by far the fastest growing segment of the Iowa population. Although there was a significant increase in the population of the larger cities and towns (over 2500 population) between 1960 and 1970, since 1970 the total state population and the population residing within incorporated municipalities have grown very slowly. The decline in farm population was significant enough during the 1960's to produce an overall decline in the population residing in unincorporated areas. Since 1970, however, the farm decline has moderated and approximately balanced the growth in rural non-farm population, so that the total population of unincorporated areas grew slightly between 1970 and 1976.

In 1960, the rural non-farm population represented 6.9% of the total state population. This figure had risen to 8.4% by 1970 and to about 10.9% by 1976. Of more significance is the growing importance of the non-farm population relative to the total rural population. In 1960, non-farm residents accounted for 22.3% of the population of unincorporated areas. By 1970 this share had risen to 31.7% and by 1976 it reached 40.9%[1]. If current trends continue, the non-farm population could exceed the farm population in rural areas by the early 1980's. This could have significant implications for the provision of public services by counties, the major local government (in addition to school districts) serving unincorporated areas.

These statewide averages conceal considerable variation among counties. Figure 1 is a map of Iowa showing the rural non-farm population in 1976 and the percentage growth in the rural non-farm population between 1970 and 1976. Figure 2 shows the rural non-farm population as a percentage of the county population and of the population of unincorporated areas.

---

[1] Since our estimates of rural non-farm population are conservative, in actuality these percentages are slightly higher.

In 1976, the non-farm population as a percentage of the population in unincorporated areas was less than 10% in only four counties. The percentage was between 10% and 30% in 38 counties, and between 30% and 50% in another 40 counties. In seventeen counties, the non-farm share exceeded 50%.

Figures 3 and 4 also depict the extent of non-farm development, with the darker shading indicating more intensive development. Figure 3 shows the estimated number of non-farm residents in 1976; Figure 4 shows the non-farm population as a percent of the unincorporated population. In both cases it is evident that non-farm development is concentrated in counties containing or adjacent to metropolitan areas, as would be expected.

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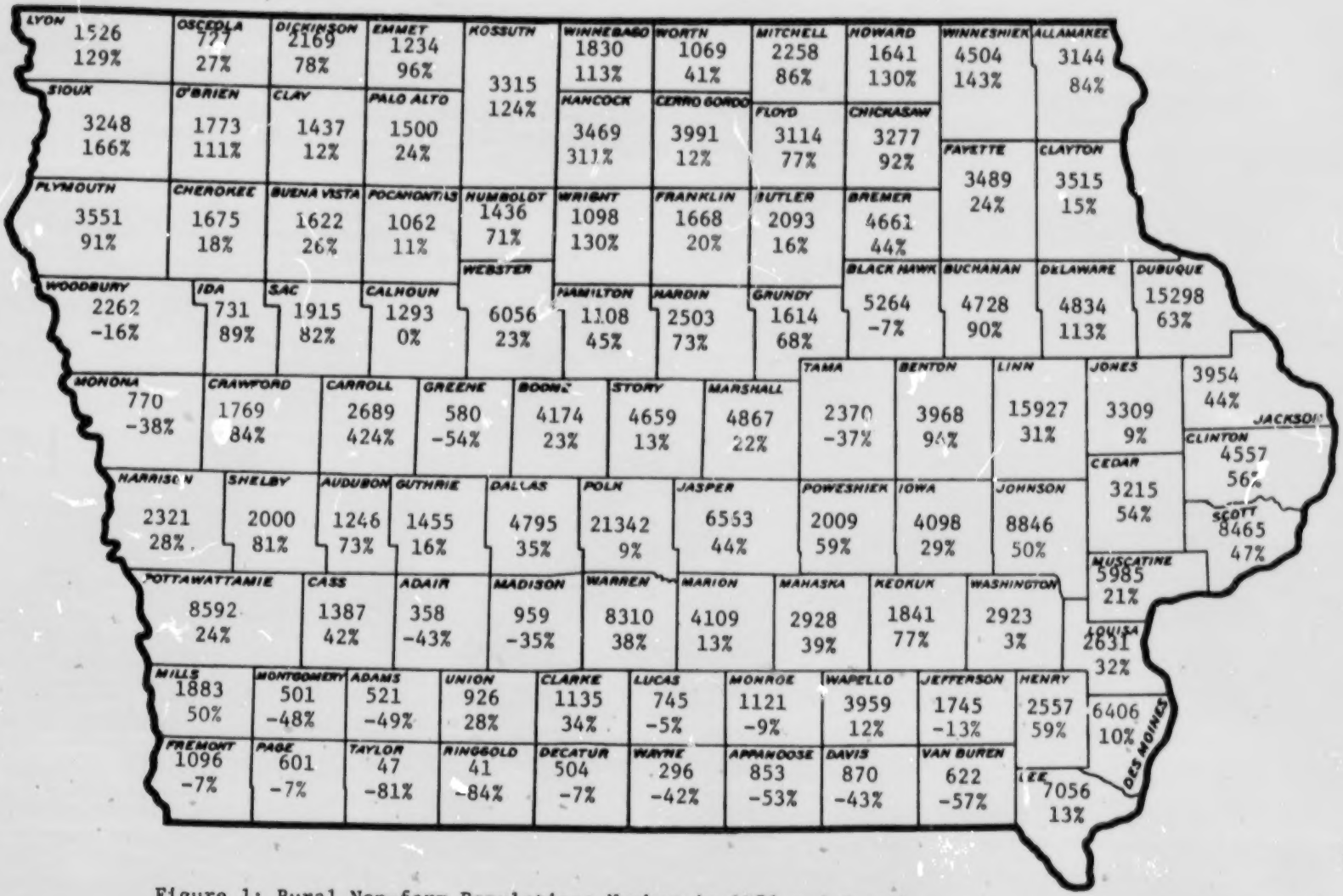


Figure 1: Rural Non-farm Population: Number in 1976 and Growth 1970-1976, for Iowa Counties.

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UPPER NUMBER: Rural non-farm population as a % of total rural population.
LOWER NUMBER: Rural non-farm population as a % of total county population.

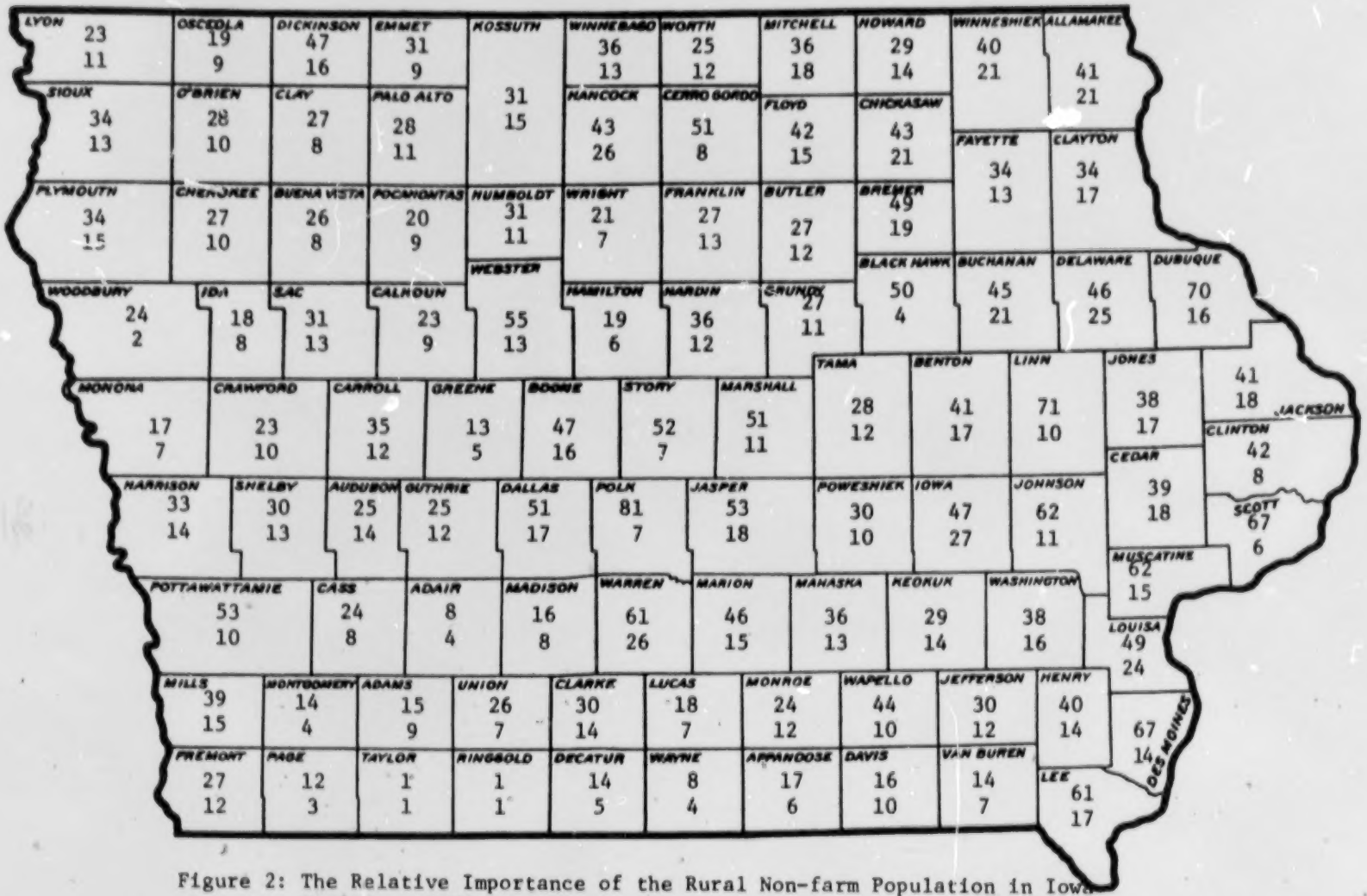


Figure 2: The Relative Importance of the Rural Non-farm Population in Iowa Counties, 1976.

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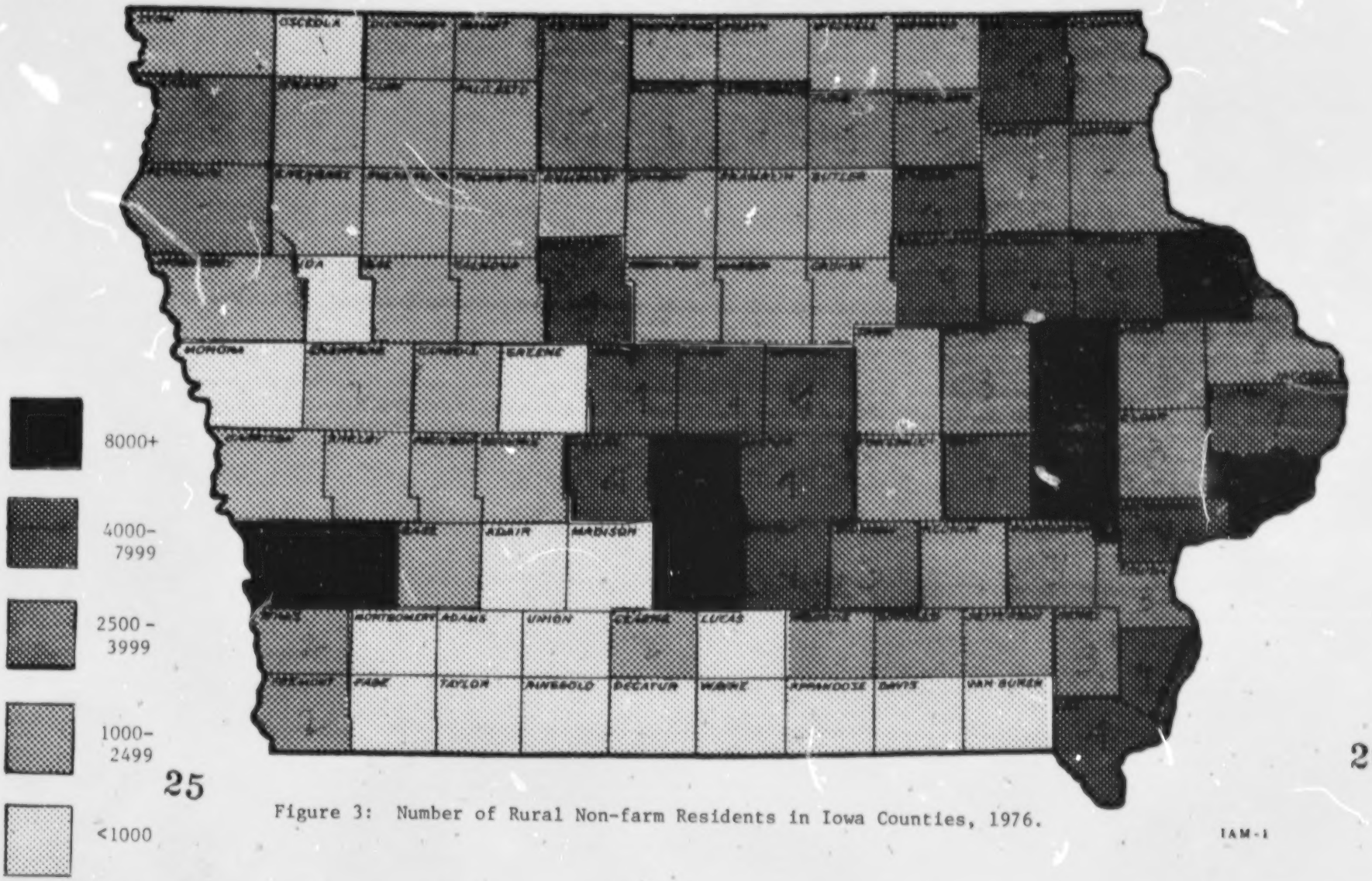


Figure 3: Number of Rural Non-farm Residents in Iowa Counties, 1976.

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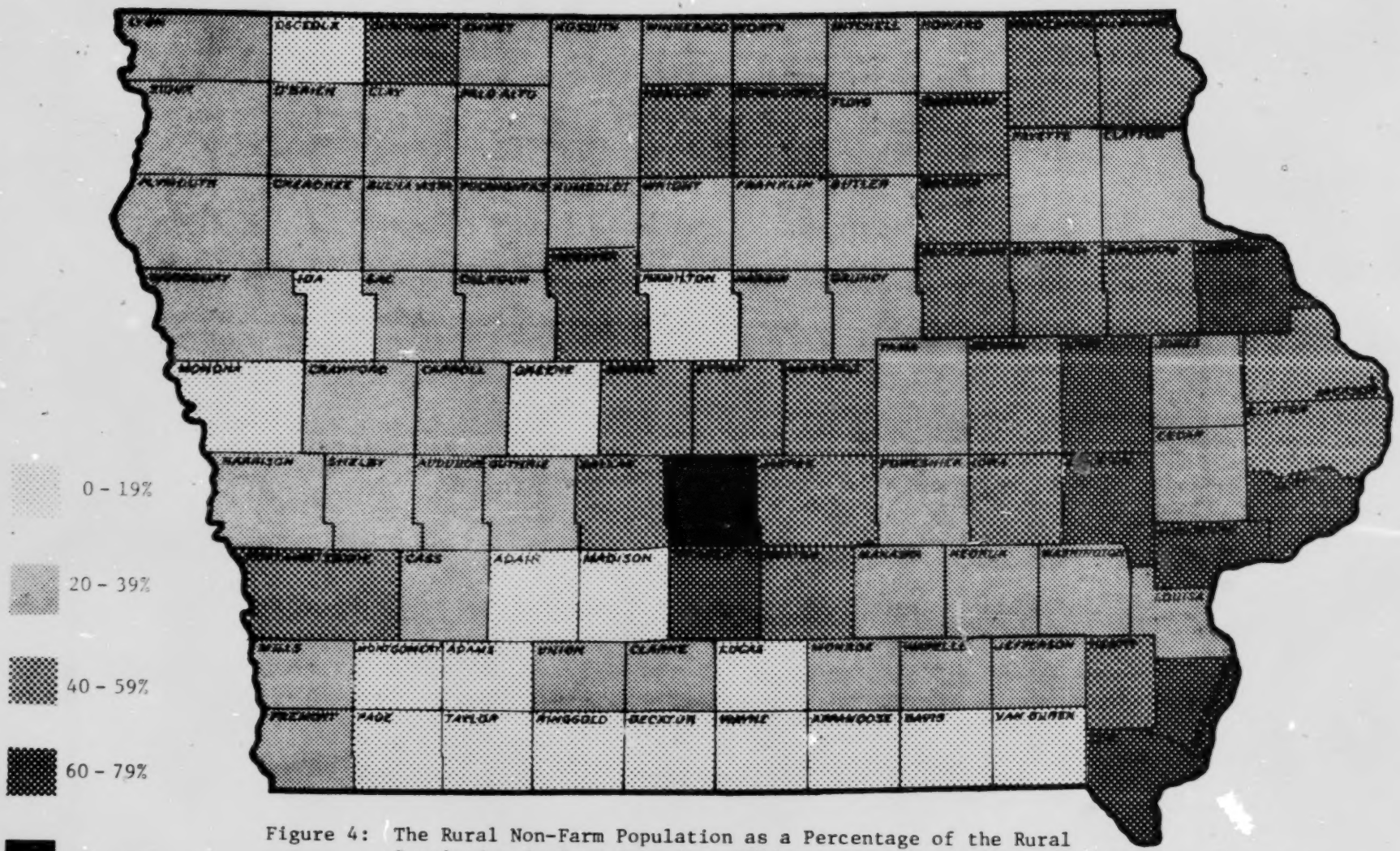


Figure 4: The Rural Non-Farm Population as a Percentage of the Rural Population in Iowa Counties, 1976.

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## B. Impacts on Local Public Services

### Roads

The secondary road fund is the largest single category of expenditures by county governments. Rural non-farm development could have a significant impact on secondary road expenditures by raising traffic volumes on county roads, surfaced and unsurfaced. Total road maintenance costs would almost certainly rise as a result of a significant increase in the rural population. Depending on the pattern of non-farm residential development (dispersed or clustered in subdivisions) traffic volumes on some gravel roads could increase to the point that surfacing is required.

It should be noted that rural non-farm development could have significant impacts on other costs associated with travel, in addition to those mentioned above. If one compares the existing pattern of development with a more concentrated pattern, where much of the rural non-farm development is channeled into incorporated urban areas, then the dispersed pattern will result in more vehicle miles traveled by auto. This, in turn, will result in greater energy consumption, a greater number of auto accidents, and increased auto emissions, and will reduce the viability of mass transit systems. The present study focuses only on the impact of development on county government finances, without making any presumption that other impacts are less important.

Insights into the effects of rural development on secondary roads were gained through a detailed case study of Johnson County, Iowa. This study focused on an area known as the "North County Corridor," a physically attractive and hilly region encompassing Lake MacBride and the Coralville Reservoir, midway between Iowa City and Cedar Rapids. This

is the area of most intense rural non-farm development in the county, and probably one of the more heavily developed rural areas in the state. It should thus provide some insights into the impacts of non-farm development when it reaches a fairly high level of concentration; these impacts are probably of a different order of magnitude from those associated with lower-level more dispersed residential development.

Expenditures for road maintenance and repair are necessitated by deterioration of the road surface, which in turn is caused by two sets of factors: (1) time and weather, and (2) vehicle usage. Increased residential development will either increase total maintenance costs (if maintenance activity increases in order to maintain the same road standards) or reduce road quality (if maintenance activity remains the same despite increased vehicle usage).

Let us assume for the moment that counties will generally try to maintain the same level of road quality as the rural population increases. Any pattern of increased residential development will then increase total maintenance costs, to the extent that costs are a function of vehicle usage. Per household costs, however, could either increase or decrease. This is because the two components of costs behave differently. The component of maintenance costs attributable simply to time and weather, independent of usage, will decline on a per household basis, as these fixed costs are spread over a larger number of households. Evidence indicates, however, that the component of costs attributable to vehicle usage will begin to rise sharply at some traffic level. These costs may rise even on a per household basis. The net effect could be an upturn in total maintenance costs per household when some level of development is reached within a given area and with a given road system.

It may well be that per capita road costs are relatively unaffected, or even decline, for low to moderate levels of non-farm development, provided the development is not highly concentrated in subdivisions. However, as traffic levels increase there is some point at which the road must be upgraded rather than simply "maintained". At some point it will be more expensive to maintain a heavily travelled gravel road than to oil it or put a hard surface on it.

The relationship between the annual costs per mile for the three different road types is illustrated in Figure 5. Gravel (and dirt) roads carry the lowest level of traffic and have relatively low initial construction costs. Maintenance costs remain fairly constant at low traffic levels.

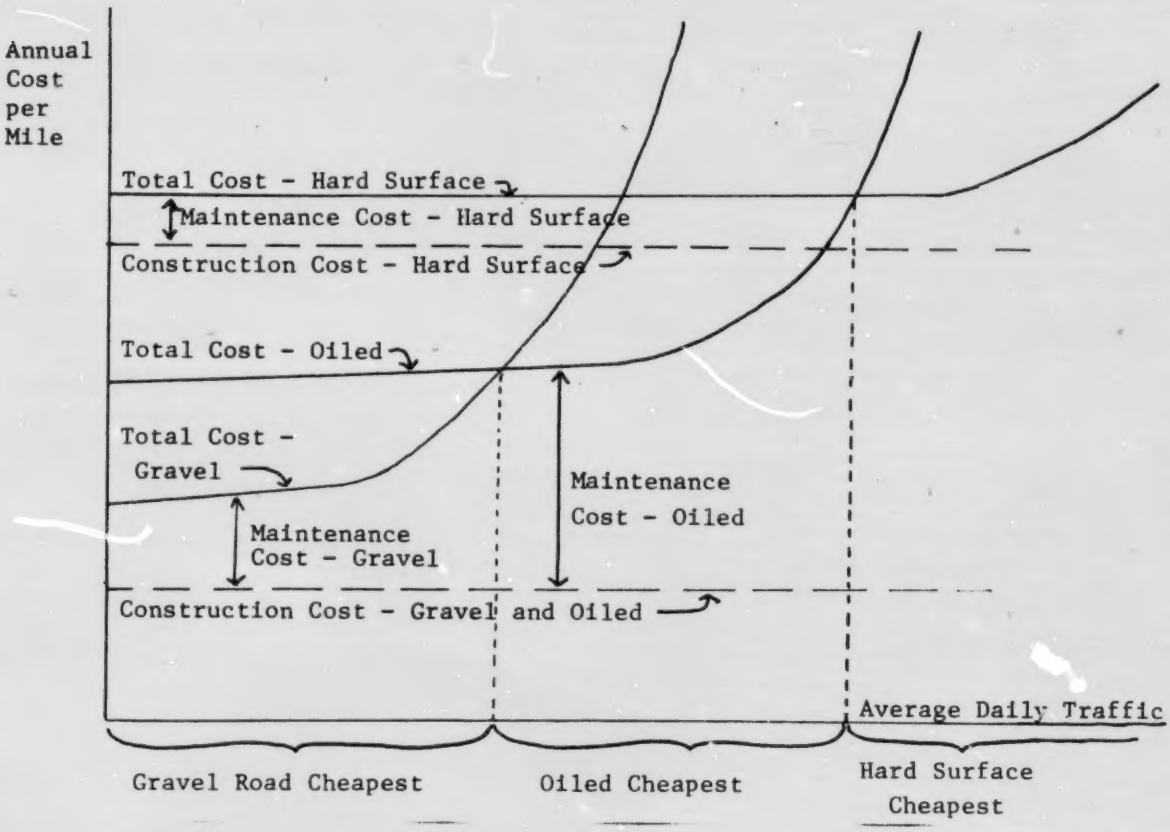
Annual Cost per Mile
Total Cost - Hard Surface
Maintenance Cost - Hard Surface
Construction Cost - Hard Surface
Total Cost - Oiled
Total Cost - Gravel
Maintenance Cost - Gravel
Maintenance Cost - Oiled
Construction Cost - Gravel and Oiled
Average Daily Traffic
Gravel Road Cheapest
Oiled Cheapest
Hard Surface Cheapest

Figure 5: Relation Between Road Costs and Daily Traffic Volumes for Three Types of Road Surface.

Oiled roads have construction costs similar to those for gravel roads and can carry moderate levels of traffic, but they have very high maintenance costs. Hard-surfaced roads can be designed to carry as large a traffic volume as desired, and have high constructions costs but relatively low maintenance costs.

Figure 5 is only suggestive of the relation between costs, since precise data are difficult to construct. County expenditure data and discussions with county engineers, however, do provide support for the pattern illustrated. The graph assumes that at some level of vehicle usage, gravel road maintenance costs will rise sufficiently that it will be cheaper to oil the road, despite the fact that oil maintenance costs (annual oiling) are several times the cost of maintaining gravel roads at lower traffic volumes. At higher volumes still, the oiled road will not hold up and it will be more economical to construct a hard surface road. Hard-surface roads are very expensive; the cost of a 6" asphalt concrete surface is approximately $75,000 per mile. If this is put on an annual basis (using an 8% interest rate, and assuming a life of around 20 years for such a road surface), the surface construction cost is between $7,000 and $8,000 per mile per year. These costs do not include grading; grading costs can be substantial since a gravel road will often need to be widened, straightened, or leveled at the time it is hard-surfaced.

County roads will not necessarily be upgraded at precisely the cost threshold points illustrated in Figure 5. For one thing, gravel roads generate dust, a substantial non-monetary cost to residents along such roads. This may result in political pressure to oil roads at lower levels of traffic volume than would be warranted if only county budgetary

costs were considered. The decision to pave a road will likewise be partly a political one, weighing a variety of non-economic considerations.

Detailed data on the daily traffic levels (averaged over the year) for every segment of county road in Johnson County enabled us to identify the thresholds for the different types of road surface. These observed thresholds, of course, reflect political as well as economic considerations. Figure 6 shows the number of miles of each type of road surface in the "North Corridor" part of the county plotted against the average daily traffic on the roads. The apparent threshold point at which a gravel road is oiled is between 150 and 300 vehicle trips per day. The oil to hard surface threshold is not so clearly defined, but appears to be between 450 and 600 vehicle trips per day.

In the rest of Johnson County the threshold from gravel to oil is closer to 300 trips per day and the threshold from oil to hard-surface is around 400 trips. The lower oil threshold in the corridor is probably due to the concentrations of non-farm residents along gravel roads and pressure by those residents to oil the roads to reduce dust. The higher hard-surface threshold in the corridor may be due to the fact that development in the corridor has occurred in the recent past and limited funds have required oiling as a stop-gap measure until the budget permits paving the high-traffic roads.

Whether residential development will push traffic volumes over the threshold, requiring road upgrading and substantial increases in county construction (hard-surface) or maintenance (oil) costs, depends on the spatial pattern of that development. A large number of non-farm households scattered over the county will probably have little effect on per-household road costs. The same households located in one subdivision could well generate traffic volumes on some county roads sufficient to necessitate surfacing.

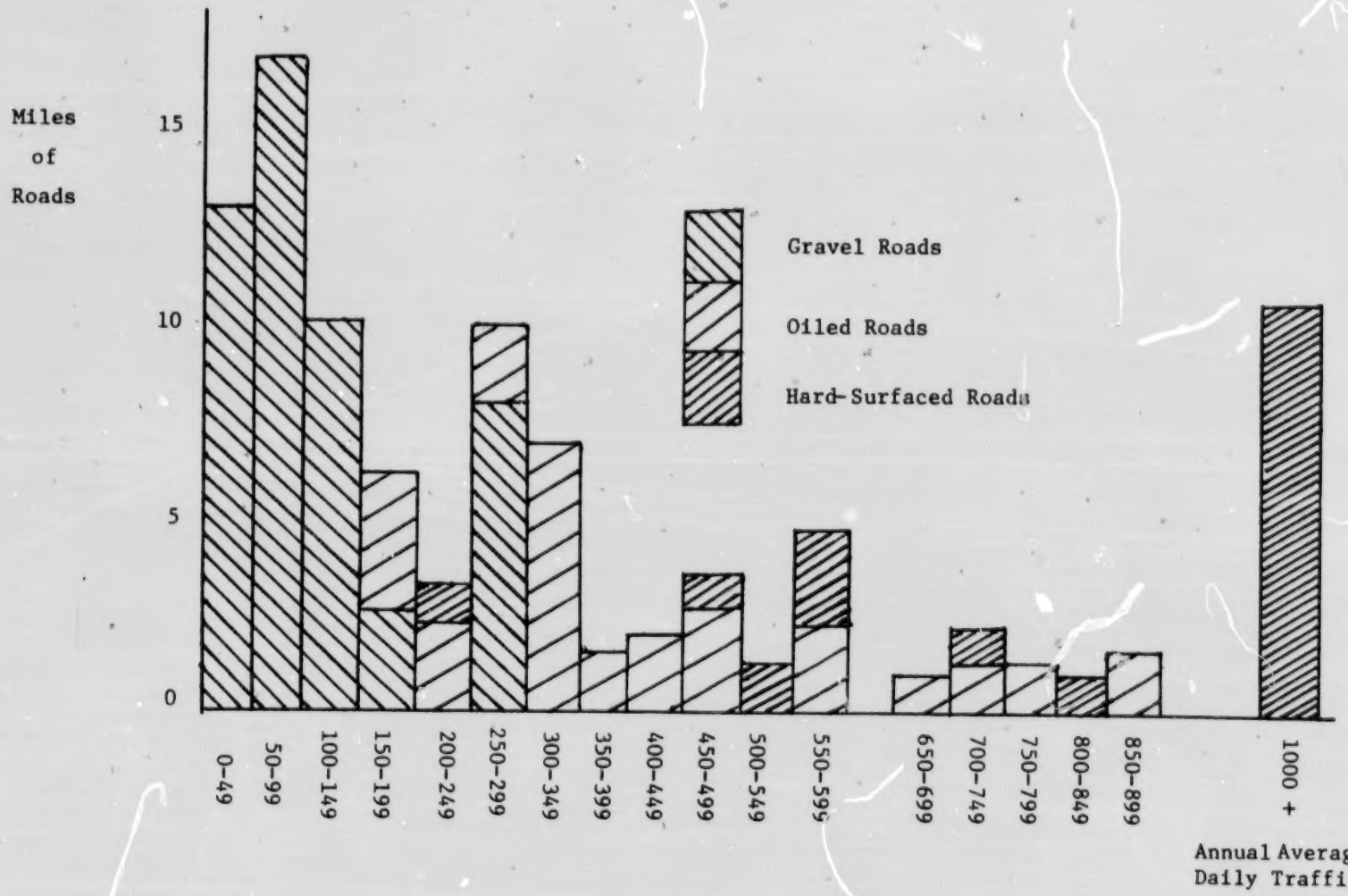


Figure 6. Miles of County Secondary Roads in the "North Corridor" of Johnson County, by Average Daily Traffic.

Research in other areas has shown that a typical non-farm residence will generate an average of seven to nine one-way vehicle trips per day. Traffic volumes on dead-end roads with non-farm residences located along them, in the north County Corridor area, indicate a slightly lower level of trip generation, in the neighborhood of six to eight one-way vehicle trips per day. On this basis, a subdivision of 25 to 40 homes could generate 150 to 300 vehicle trips per day. It is likely that there will be substantial concentration of these trips along certain routes leading to retail and employment centers and schools. This level of trip generation would thus be sufficient to induce the oiling of at least some roads serving the subdivision. If there were substantial farm-related traffic or through traffic from other non-farm homes on these roads, a subdivision of this size could well push traffic levels over the hard-surface threshold.

To gain an idea of the potential magnitude of the impact on road costs, we chose to examine a particular subdivision of 24 homes in the North Corridor. These homes are responsible for almost all of the daily traffic (around 185 trips per day) on two particular segments of county road totalling 2 3/4 miles. If seventy-five new homes were constructed, with the road in question as principal access, traffic volumes would rise to around 700 trips per day, well above the threshold for hard-surfacing. The surface construction cost for the 2 3/4 miles of road would be around $206,000, or $21,000 on an annual basis. This amounts to about $280 per year for each of the 75 new households. (For comparison purposes, a home assessed at $60,000 currently would pay around $180/year into the county secondary road fund). Clearly, once the hard-surface threshold has been passed, the more development the better, permitting the construction

costs to be spread over more households. The most costly pattern of development would be one in which residences were concentrated just enough to require all access roads to be hard-surfaced, but not enough to bring the per-household cost back down closer to the average household tax contribution. County taxes would have to be raised substantially in such a case.

Generalizations are difficult to draw, since the actual impact of non-farm development on road costs will depend on existing county road patterns and traffic volumes and on the density of the development and its location. The closer are the existing traffic volumes to threshold levels, the farther the development is from employment and retail centers, the more concentrated is the development, and the lower the quality of the roads used by the new non-farm residents, the greater will be the impact of new development on road costs.

A statistical analysis of county secondary road expenditures for all counties in the state in 1970 and in 1976 revealed the following tentative relationships: (1) a larger rural non-farm population is associated with a higher level of total road expenditures. This relation is statistically significant, controlling for differences in per capita income, and land area. (2) Road expenditures increase less rapidly than population. Thus an increase in rural non-farm development results in a decline in per capita or per household road expenditures.[1]

The unknown factor in this analysis is the condition of the roads in each county. That is, we can only observe expenditures, not the factors which determine expenditures: (1) the level of service provided, and (2) the cost per "unit" of service. Declining per household expenditures could be due to the fact that costs of maintaining roads to a given

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[1]See Appendix B for details of the statistical methodology and results.

standard increase less rapidly than population (due to fixed costs related to weather rather than use). On the other hand, it could be that population growth has a delayed effect on road expenditures and/or that county budgets do not permit the increase in expenditures required to maintain road quality. Thus declining per household expenditures may be only a short-run phenomenon or may reflect deteriorating road quality. It may be service levels rather than costs that decline as population grows.

Police Protection

The sheriff's office accounts for another significant share of county government expenditures. Although numerous studies have found a clear association between population density and crime rates, it is doubtful that the levels of density brought about by rural subdivisions are sufficient in themselves to have a measurable effect on crimes per 100,000 population in rural areas. Another factor affecting crime, however, is simply population growth. It has been hypothesized that rapidly growing areas tend to lack the network of ties between relatives and neighbors and the sense of community belonging and pride that develops over the years in more stable neighborhoods, in small towns, and in the farming community. This social instability, in turn, is thought to lead to a higher incidence of crime and less effective law enforcement.

One could argue that if the residential development occurring in rural areas had been redirected into incorporated areas, overall county crime rates would have been lower. This would be true if the population growth could have been absorbed in established communities without significantly affecting crime rates there. This is highly speculative. Nonetheless, two things remain clear: (1) Rural crime rates have been increasing significantly in recent years. The Iowa Uniform Crime Reports

for 1977 indicate that the index of property crime and the index of total crime both increased an average of 12% per year in rural areas between 1972 and 1977, a significantly higher rate of increase than that of non-rural areas. Violent crime, on the other hand, increased more rapidly in SMSA's (counties containing a city of 50,000 population or more). (2) Even if rural non-farm development does not contribute to higher crime rates, it is more expensive to provide police service the more dispersed

Table 2

Average Annual Percentage Change
in Crime Rates — 1972-1977
in Iowa

| | SMSA's | Other Cities | Rural Areas |
|---|---|---|---|
| Violent Crime: | +13.0 | +4.0 | +7.0 |
| Property Crime: | +8.8 | +6.8 | +12.0 |
| Total: | +9.0 | +6.8 | +12.0 |

SOURCE: Iowa Department of Public Safety, Iowa Uniform Crime Report, 1977.

is a given population. That is, even if the average number of sheriff's calls per household would have been the same regardless of the pattern of development, it costs more to respond to calls if they come from dispersed rather than concentrated locations.

An attempt was made to assess these impacts by analyzing county sheriffs' expenditures for 1970 and 1976. The results in both years were highly significant statistically. They indicate that an increase in the rural non-farm population share amounting to ten percentage points is associated with a 20% to 30% increase in per capita sheriff's expenditures. For 1976, the average county spent about $13.75 for every person in rural areas or

small towns (under 2500). A county with 50% rural non-farm population could be expected to spend about $2.80 more per capita than a county where this share was only 40%.[1]

The limited data available from the Johnson County Sheriff's Office did not permit a satisfactory test of the hypothesis that rural non-farm development increases the cost of police protection in rural areas. The office has recently begun to keep statistics on calls answered by geographic areas. However, only 3 rural subdivisions are identified separately, making it difficult to arrive at convincing figures comparing police calls per household in rural farm areas with calls per household in subdivisions. For the three subdivisions in question, there were .2 calls per household during the first ten months of 1978. For a rural sector of the county, containing 86% farm households, the corresponding figure was about .5 calls per household. It would be inappropriate to draw any conclusions from this very limited data.

Additional insights can be gained by comparing 1977 rural crime rates (that is, reported crimes per 100,000 persons for unincorporated areas and towns served by the county sheriff) with per capita sheriff expenditures and the extent of rural non-farm development. Crime rates are significantly correlated with sheriff's expenditures (.28), with the rural non-farm population share (.46), and with the overall growth rate in rural and small town population (.38). There was a negative correlation (-.20) between crime and the percentage growth in rural non-farm population between 1970 and 1976, but this correlation was barely significant statistically.

Regression analysis reveals that the major factor leading to the correlation between rural crime rates and rural non-farm population share

[1] See Appendix B for details of the statistical methodology and results.

may be the high correlation between the latter share and the degree of urbanization. That is, high overall county population density (due to presence of a major city) may lead both to significant rural development and to higher crime rates spilling over into rural areas. The analysis also reveals that a higher rate of growth in the population of rural areas and small towns is significantly associated with higher crime rates.

Schools

Rural non-farm development is likely to have a significant impact on school district finances, more significant than on any other local public service. This is because the spatial pattern of residential development profoundly affects two major components of school costs: (1) bussing costs, and (2) school construction.

The cost of transporting students to school must be higher if the school population is dispersed over a large region. At the same time, the desire to minimize the transporting of elementary school students may lead to the construction of new schools in outlying concentrations of population.

A case study of the Iowa City school district revealed significant impacts on school bussing costs.[1] The Iowa City school district is quite large, encompassing substantial rural areas to the south and north, including a share of the heavily developed North County Corridor. Although the school population for the district as a whole is declining, there has been a substantial shift in population towards outlying areas. The district thus provides a case study of the impacts of population dispersal on school costs for a metropolitan region.

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[1] See acknowledgments for reference to this study.

For the 1976-77 fiscal year, the Iowa City school district spent about $130 for each student bussed within the urban portion of the school district, and about $133 for each student bussed from rural areas. However, the rural areas generate far more bussed students per household than the urban areas. Spreading the bussing costs over all students yields very different figures. It costs about $20 per urban student to bus urban students, whereas it costs about $114 per rural student to bus rural students. In other words, a shift in a given number of school children from the urban to the rural part of the district would increase the bussing costs associated with that group of students more than fivefold.

In addition to raising costs, rural development will aggravate inequities in the financing of schools. In the Iowa City school district, urban residences contribute about 88% of the total residential property tax revenues of the school district, rural residences contributing about 12%. Urban residents, however, account for only about 48% of total bussing costs, rural residents accounting for 52%.

Although only about 48.5% of the total school budget is financed by property taxes, it is probably best to view bussing expenditures as if they were 100% property tax-financed. Federal and state aids are unaffected by bussing costs; thus any increase in bussing expenditures must be met entirely by an increase in local taxes or by a reduction in expenditures or salaries, facilities, programs etc. Since about 86.8% of the tax base was residential, about $264,547 of the total of $304,778 in bussing costs in 1976-1977 had to be financed by taxes on residences. The average urban residence was responsible for about $7.18 in bussing costs, but contributed about $11.49

towards the total of $264,547. The average rural residence was responsible for $85.46 in bussing costs but contributed only about $16.36 in property taxes towards bussing.

The urban resident is clearly subsidizing the bussing of rural students. Within rural areas, the farm population will be subsidizing the non-farm since property taxes per farm will be substantially higher than property taxes per non-farm residence.[1] It is important to note that the efficiency impacts discovered for the Iowa City school district will occur even where the rural area and urban area are in separate school districts. That is, the overall amount of resources devoted to school bussing in the metropolitan area will be greater if population is dispersed into rural areas, regardless of where school district lines are drawn. However, if the rural areas were in a separate district, the urban taxpayer would no longer subsidize the rural student. The farm subsidy of the rural non-farm student would remain.

Non-farm development is especially significant in a period of declining school enrollments statewide. This decline produces excess capacity in public schools, and will force school closings in many instances in order to hold down per pupil costs and utilize facilities efficiently. The ideal situation from the standpoint of costs would be one in which most of the enrollment decline was concentrated in one or a few attendance districts. The choice of which school to close would be easier. With attendance declines spread evenly over a district, closing any school will result in higher bussing costs. Thus if rural development were to occur in areas contiguous to the urbanized area, the effect could be to sustain enrollments in suburban schools and leave the central city schools to bear the

[1] Statewide agricultural property taxes per farm (after veterans, homestead and ag land credits) were about ten times residential property taxes per residence (after veterans and homestead credits), for taxes payable in 1976-1977.

brunt of enrollment declines and closings. The impact of such rural development on overall school costs could be favorable, if the alternative development pattern were one in which school enrollment declines were spread over the entire urban area.

If rural development is more extensive and/or occurs beyond walking distance from existing elementary schools, impacts are likely to be negative. In fact, development could result in overcrowding of suburban or outlying schools at the same time that urban school population is declining. Any decision to construct new schools in growing outlying areas is likely to be unpopular at a time when other district schools are underutilized and facing the possibility of closure. The more likely solution will be the redrawing of attendance district lines to shift school children into available facilities. This, in turn, will raise bussing costs throughout the district. Thus the difference in the cost of bussing an urban versus a rural student will understate the full impact of population dispersal, since the urban student bussing costs themselves will have been forced upward by the redrawing of district lines and the resulting longer bus trips.

It should be noted that the Iowa City school district is not typical, and may be in a better position by virtue of the fact that district boundaries encompass a large share of Iowa City's fringe development. District enrollments will decline less than they would if the school district were coterminous with the city. This enables the district to partially solve the excess capacity problem by re-drawing attendance lines, shifting enrollment from fringe schools (which are potentially over-crowded) to more centrally-located schools. If children from fringe developments were in a different district, such

adjustments would be impossible. The fringe district schools would become overcrowded, and more city schools would have to be closed. Thus a district such as Iowa City may be in a better position to handle capacity problems and attendance shifts and declines, even though bussing costs will increase (with fringe development being subsidized by urban taxpayers).

It should be noted that many rural school districts will look favorably on increased residential development within their districts. In Johnson County, the College School District is an example. It encompasses 140 square miles, including a portion of the southern edge of Cedar Rapids. The district is overbuilt in terms of school capacity, largely in anticipation of extensive suburban development which hasn't occurred. Additional school children could probably be accommodated at little additional expense, and the additional tax base produced by new development could well result in a lower school tax rate.

Such positive impacts, from the local perspective, should be weighed against negative impacts in other districts experiencing a decline in enrollments and tax base. It is impossible to draw any general conclusions regarding different patterns of development and overall school costs. The characteristics of the particular school districts in question will be determinative. One can say that the more dispersed is population the higher will transportation costs be. However, bussing costs are only a small share of total school costs.[1] Salaries will be a major cost, and salaries are likely to be higher in urban areas. Shifts in population to rural

[1] In the Iowa City school district, bussing costs are less than 2% of total expenditures. In rural districts, this figure will be higher.

areas could reduce measured per pupil instructional costs. Finally, the effect on capital costs is largely indeterminate, but could well be negative.

Fire Protection

Fire protection in rural areas of Iowa is usually provided by a volunteer fire department through a township or a benefitted fire district. It is unlikely that rural non-farm development has a significant impact on fire protection costs. The major component of costs for a volunteer department will be fixed costs (purchase of equipment, overhead on the fire station, etc.). The only costs likely to be affected by the number of fires responded to are fuel costs and a portion of equipment maintenance costs. It is highly likely that most rural fire departments have sufficient capacity (in terms of equipment) to handle many more fires. New developments are unlikely to necessitate additional capital expenditures unless they become so extensive that the residents demand their own fire station.

Where substantial rural development occurs at some distance from existing fire stations (generally located within the towns), the rural residents will bear the cost of poor fire protection through high fire insurance rates. If better fire service is desired (in terms of shorter response time), a new fire station would have to be constructed near the subdivisions in question. It is unlikely that the existing fire district would be willing to finance a new station benefitting only a portion of the district's residents. The alternative would be formation of a new fire district; however, present state law prohibits establishment of any new benefitted fire districts.[1]

Information on fire districts is scanty. At the state level, the only information consists of property taxes levied by fire districts

[1] Iowa Code (1977), Chapter 357B.1.

and collected by counties. It is probably not safe to assume that property tax levies finance a constant share of fire district expenditures across all fire districts, so that expenditures cannot be inferred from tax levies. Budgets and expenditure data are probably kept very informally by individual districts, and are not reported to the state.

A casual survey of fire district chiefs in Johnson County provided rough confirmation of the hypotheses mentioned above. Capital expenditures were reported to be unaffected by the extent of rural non-farm development. Fuel and vehicle maintenance costs were a small proportion of fire district expenditures (on the order of 10%).

Water and Sewer

It can be safely assumed that the majority of residences in unincorporated areas are served by individual private wells and septic tanks. However, there are some benefitted water districts in rural areas. More important are the twenty-six rural water districts in Iowa, covering about 1/3 of the land area of the state. More rural water districts are in various stages of planning and organization. Most of these rural water associations are in Southern Iowa and the Northwest corner. They are non-profit corporations for the purpose of providing a water distribution system in rural areas, primarily for farmers. It is the intention of the Farmers Home Administration, which administers low-interest loans for up to 50% of the construction costs of a rural distribution system, that the program not encourage rural subdivisions.

The extent to which rural non-farm residents are served by existing rural water associations in Iowa is not known at present. However, it is difficult to see how non-farm residents could be excluded from membership in an association serving their area. Permitting subdivisions to

participate may be attractive to a water association if the membership fee covers a substantial share of capital costs. This will be true if the fee is a flat amount per household, since the cost per household of constructing the distribution system will be lower in more densely populated areas. On the other hand, if households must pay only the actual incremental cost of providing water service there would be no particular incentive to extend membership to subdivisions.

Probably more important is the impact of rural water associations on the rate of non-farm development, rather than vice versa. Since capital costs can be financed on favorable terms (up to forty years for repayment at 5% simple interest), there is a potential for the rural water program to subsidize non-farm development. This depends crucially on the pricing structure used by rural water associations. It also depends on the location of the associations. Any association established in the vicinity of a metropolitan area has the potential, at least, for attracting suburban development.

Water is sometimes provided to clusters of homes in unincorporated areas through community wells. These would generally be operated and financed by a community association or homeowners association. The problems here are more likely to be environmental than financial. To the extent that rural non-farm residents provide and pay the full cost of their own water service, there is no impact on others. There may, however, be serious problems regarding the quality and adequacy of available groundwater. This issue is beyond the scope of the present study.

Sanitary sewer service may be provided in unincorporated areas by a sanitary district, which has the power to issue bonds and levy property

taxes and special assessments, or by a homeowners association, which must finance sewer costs through membership dues or fees. In either case, the costs are internalized. Again, the major issues are probably environmental: the adequacy of small privately provided sewage treatment systems and the effects of unsewered subdivisions on the quality of groundwater. In the past decade or so, a small number of sanitary districts have been formed in Iowa (less than a dozen). Information on homeowners' associations and their treatment systems is difficult to obtain.

At present, impacts of rural non-farm development on the demand for rural water and sewer systems appear to be minimal. To the extent that services are provided by homeowners associations the fiscal impacts are internalized. There is a potential, however, for water or sewer districts which are Federally subsidized to stimulate further development.

Solid Waste Disposal

For the majority of Iowa counties, solid waste disposal service consists of provision for a sanitary landfill, as required by environmental regulations. In most cases, the landfill is managed by the county, jointly by the county and a city, or privately on contract with the county. A few counties go beyond this, providing collection boxes at various locations around the county. As of February, 1977, there were at least seven counties providing such service, but probably not more than ten or twelve (based on responses to a questionnaire sent out by the State Association of Counties). The box pickup system can be expensive; Johnson County spent around $22,000 in one year before abandoning the system.

With only a landfill system, the cost to the county of additional usage by non-farm residents will be fairly minimal. The resident bears

the major cost--the cost of transporting the trash from the home to the landfill. With the box pickup system, the county bears a portion of this cost. Still, the cost per household is likely to remain unchanged as long as non-farm households place demands on the service similar to those of farm households. Farmers may dispose of trash privately, however, leading to relatively greater use of the landfill and/or pickup boxes by non-farm residents. On the other hand, rural subdivisions with homeowners' associations may contract with private trash haulers and so not use the pickup boxes at all. There is, of course, no systematic information regarding who makes use of pickup boxes. Impacts on costs with a collection-box system are therefore uncertain, but not likely to be of significant magnitude.

Health, Welfare, and Social Services

A major share of county government spending is in the area of health, welfare, and social services. These services were not examined in this report on the presumption that the pattern of development has little or no impact on the costs of providing such services. One exception is ambulance service; the costs of serving a given population would be somewhat higher the more dispersed is that population.

# III. CONCLUSIONS AND POLICY RECOMMENDATIONS

## A. Summary of Public Service Impacts

The conclusions of this study with regard to the impacts of rural non-farm development on local public service demands and costs can be summarized as follows:

(1) In the short run, at least, and for lower levels of rural development, it appears that non-farm development may lower per capita expenditures on county secondary roads. That is, maintenance expenditures increase less rapidly than population. However, this does not mean that non-farm development has a beneficial effect on the provision of roads. First, the lower per capita expenditures may reflect deteriorating quality of service rather than lower costs. Second, this may be only a short-run phenomenon. More concentrated development could push traffic volumes on certain roads over the threshold level, so that gravel roads will need to be oiled (greatly increasing maintenance costs) or hard-surfaced (necessitating large initial construction costs). Third, if much rural development were-redirected into urban areas, the net effect on road expenditures in both rural and urban areas could be positive.

(2) There is some evidence (though it is not conclusive) that higher rates of rural non-farm development are associated with higher rural crime rates and higher per capita sheriffs' expenditures.

(3) The dispersal of population into rural areas will increase school bussing costs. Depending on where school district boundaries are drawn, there could also be a substantial impact on school construction

costs. That is, schools in developing fringe areas may have to be enlarged at the same time that central city schools are becoming underutilized and may have to be closed.

(4) Impacts on other services such as water, sewer, solid waste disposal, and fire protection are not likely to be substantial. Water and sewer service in rural areas is generally privately provided except in areas served by a rural water association. The resident bears the major cost of transporting solid waste to the landfill in the vast majority of counties. Rural fire districts will generally feel little impact on costs as a result of new development provided, rural subdivisions are not so large and concentrated as to require an additional fire house.

(5) A variety of services in the general area of health, welfare, and social services are generally provided to people in such a way that costs are unaffected by the location of the county residents served. This broad category of expenditures accounts for a large share of county government spending.

B. Implications for Local Government Structure and Finance

The impact of non-farm development on public service expenditures, and on the distribution of the tax burden among population groups, depends crucially on the location of that development and the geographic boundaries of the unit providing the particular service. Impacts are minimized whenever there is a close coincidence between the group of households benefitting from a service and the group paying the costs. For this reason, it would appear at first glance that homeowners' associations and special districts are, in some respects, the ideal vehicles for providing those services with a very localized and identifiable group of beneficiaries. These would include water distribution systems, sewer collector systems and sewage treatment plants, local streets, fire protection, and trash collection.

If increased development raises the cost of providing one of these services, by necessitating sewage treatment for example, there will be no fiscal impact on existing rural residents or neighboring cities if this increased cost is borne entirely by the new development responsible. This will be the case if the service is provided by a homeowners' association or a special district. If non-farm residents were forced to pay a larger share of the full costs associated with their residential location choice (including any environmental costs), there would be less need for public concern regarding development patterns.

Homeowners' Associations

A Homeowners' Association (HOA) is a private corporation. It manages various common properties such as streets, open spaces, and recreational facilities. A HOA is formed initially by the developer, and membership automatically accompanies a land purchase. At some point, control of the association is turned over to the homeowners. A HOA is not a governmental unit and so cannot levy taxes. Its expenses must be financed either by membership fees or dues, or user charges. Fees can be made a lien against the homeowner's property.

Homeowners' associations provide a number of services which in urban areas would be provided by a government. These include water and sewer systems, the maintenance of roads within the subdivisions, and trash collection. Such systems of service provision should probably be encouraged. However, a number of problems exist. First, a HOA is at a disadvantage relative to a local government in that all costs must be borne entirely by the residents; intergovernmental grants are unavailable and there is no commercial and industrial tax base. Second, a HOA is not in a position to issue debt for the financing of large capital expenditures. Even

if it were able to borrow money, it would have to pay a relatively high interest rate, since the bonds would not carry the tax advantages of municipal bonds.

The inability to borrow is not a serious problem once possibilities for contracting are recognized. A HOA may be unable to afford to purchase a trash compacter or a snow plow, but it can contract with private providers to collect trash and clear the streets. A HOA may also contract with the county or a neighboring town to provide certain services. Although such cooperative agreements between a private agency and a government are permissible under Chapter 28E of the Code of Iowa, it is not known if this provision has been used by a HOA.[1]

Contracting does not get around problems associated with one large and important category of capital spending--street construction. The limited resources of HOA's, combined with the inability or unwillingness of counties to impose construction standards for private roads, frequently leads to substandard roads. This, in turn, leads to burdensome maintenance costs and/or demands for the county to take over the streets.

Special Districts

A homeowners' association as a legal entity is tied to a well-defined subdivision through covenants and restrictions written in the deeds to the land. A special district is not constrained to particular boundaries in this fashion, and so is more flexible. District boundaries can be drawn to include a population large enough to support a service at a reasonable per capita cost. This can be important if a large initial capital outlay is required.

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[1] See "A Handbook on Integovernmental Cooperative Agreements in Iowa," Institute of Public Affairs, University of Iowa, September, 1978.

Benefitted water districts can be formed by the County Board of Supervisors upon receipt of a petition signed by at least 25% of the affected resident property holders. Sanitary districts can be formed if at least 25 persons living in contiguous areas petition for an election, and if the issue gains a majority vote of the affected residents. A secondary road assessment district can be established by the County Board of Supervisors upon receipt of a petition signed by 35% of the landowners within the proposed district, which cannot extend more than 1/2 mile on either side of the roads to be improved. The water and sanitary districts can levy taxes and special assessments and issue bonds. The secondary road district is exclusively a special assessment district.[1]

In addition to having more flexible boundaries, the special districts appear to have considerable financing advantages over homeowners' associations. In the case of debt finance, however, special districts can encounter considerable difficulty in selling bonds since the district will not generally have a bond rating. Such bonds are bound to appear riskier than those issued by a general purpose local government or by an established school district.

Despite the advantages of special districts, in terms of imposing public service costs directly on the beneficiaries and avoiding the subsidization of sprawl, there are serious drawbacks. First, a proliferation of governments can hinder coordinated decision-making and planning and confuse voters as to the public officials responsible for different services. Second, it may not be desirable to grant to a special district the authority to plan and build service infrastructures (such as water

[1]See Code of Iowa (1977), Chapters 357, 441, and 311.

and sewer systems) without at the same time having any control over land use, which can be profoundly affected by that infrastructure. Third, the establishment of special districts in unincorporated urban fringe areas may be an impediment to annexation, and annexation may well be the more desirable long-run solution.

The first problem could be solved by the passage of enabling legislation for the formation of "urban service districts." Such districts would provide or contract for only a limited range of services, and would fall short of being general purpose governments. They would permit a single election to establish a common board of trustees for managing all services (water, sewer, fire, trash collection, street clearing, street lighting, and perhaps others) within a single set of district boundaries. It would seem, however, that if the residents of an area were willing to establish such a district they would be better off simply incorporating instead. Incorporation would enhance borrowing ability, would bring with it the power to regulate land use and to have a police force, and would make them eligible for federal revenue sharing and other grants.

Finally, it should be mentioned that the implementation of county home rule may alter the status of secondary road assessment districts. The Board of Supervisors may be able to establish such districts without a petition from the residents affected. Bonds issued to finance road improvements within the district would then be backed by the county government, avoiding the problems with special districts issuing their own bonds.

## C. Implications for Land Use Policy

Since this report has focused exclusively on the public service impacts of rural non-farm development, it would be inappropriate to draw any conclusions regarding land use policy. The environmental and social impacts of development may be quite significant, and an analysis of such impacts may well point to different kinds of policies. Nonetheless, it appears safe to say that if one were to consider only public service costs, impacts could be minimized through either of two policies: (1) Force development to occur at very low densitites and in scattered locations so as to minimize any effects on costs; (2) Force development into a small number of designated areas at high densities, so that the development could eventually be self-supporting. Special districts, urban service districts, or HOA's could provide services in the short run, with ultimate incorporation the goal.

These two policies could, in fact, be combined. For example, one residence per quarter/quarter section (40 acres) would be permitted; development at any higher density would require platting as a subdivision and would be subject to county approval and subdivision regulations. The object would be to avoid a land use pattern in which a large number of subdivisions of moderate density is scattered over the rural area. Such subdivisions could be substantial enough to have a sizeable impact on costs such as road improvements, school bussing, and police, but not concentrated enough to warrant incorporation as a city or formation of special districts. The cost increases would be shared by all county taxpayers.

## D. Conclusions

The precise impacts of rural non-farm development will depend crucially on the particulars of the situation--the location and density of the development, the current school capacities, the condition and current traffic levels on public roads, etc. Local governments thus need to exhibit considerable flexibility in dealing with rural development. Further investigation would appear warranted to identify any constraints on the ability of local governments to deal effectively with the provision of services to rural non-farm residences and with the control of land use. Some possible examples are: (a) prohibition of formation of new fire districts, (b) impediments to a more equitable assessment of school bussing costs, (c) inability of county supervisors to employ special assessment powers for financing road improvements, (d) constraints on ability of homeowners' associations to pay for and receive county services at a higher level than that provided county-wide.

In addition to removing constraints such as those identified above, state policy should also be directed at the removal of any incentives embedded in existing state law which encourage the dispersal of population from urban to rural areas. Although the control of land use may best be left to local government, the state should at least avoid subsidizing sprawl or otherwise contributing to local land use problems. An example may be the use-value assessment of farm land (in the absence of a workable rollback provision), which can amount to a subsidy to land speculators and a stimulus to leap-frog development in urban fringe areas. Further investigation of this area may also be needed.

# APPENDIX A

Population of Iowa Counties
for 1960, 1970, and 1976

APPENDIX A

Table 1

Population of Iowa Counties, 1960

| | County Number and Name | Population for: Total County | Cities | Unincorporated areas | Rural Farm | Rural Non-farm |
|---|---|---|---|---|---|---|
| 1 | ADAIR | 10893 | 4539 | 6354 | 5732 | 622 |
| 2 | ADAMS | 7468 | 2738 | 4730 | 4127 | 603 |
| 3 | ALLAMAKEE | 15982 | 7556 | 8426 | 7398 | 1028 |
| 4 | APPANOOSE | 16015 | 10343 | 5672 | 4632 | 1040 |
| 5 | AUDOBON | 10919 | 4806 | 6113 | 5675 | 438 |
| 6 | BENTON | 23422 | 13077 | 10345 | 8607 | 1738 |
| 7 | BLACK HAWK | 122482 | 104323 | 18159 | 8385 | 9774 |
| 8 | BOONE | 28037 | 17214 | 10823 | 6466 | 4357 |
| 9 | BREMER | 21108 | 12371 | 8737 | 7302 | 1435 |
| 10 | BUCHANAN | 22293 | 10770 | 11523 | 8848 | 2675 |
| 11 | BUENA VISTA | 21189 | 13268 | 7921 | 7015 | 906 |
| 12 | BUTLER | 17467 | 8916 | 8551 | 8004 | 547 |
| 13 | CALHOUN | 15923 | 8801 | 7122 | 6767 | 355 |
| 14 | CARROLL | 23431 | 14103 | 9328 | 8247 | 1081 |
| 15 | CASS | 17919 | 11112 | 6807 | 6221 | 586 |
| 16 | CEDAR | 17791 | 8661 | 9130 | 7467 | 1663 |
| 17 | CERRO GORDO | 49894 | 39324 | 10570 | 6929 | 3641 |
| 18 | CHEROKEE | 18598 | 11201 | 7397 | 6953 | 444 |
| 19 | CHICKASAW | 15034 | 7349 | 7685 | 7167 | 518 |
| 20 | CLARKE | 8222 | 4165 | 4057 | 3531 | 526 |
| 21 | CLAY | 18504 | 11491 | 7013 | 5958 | 1055 |
| 22 | CLAYTON | 21962 | 10576 | 11386 | 10096 | 1290 |
| 23 | CLINTON | 55060 | 43078 | 11982 | 9449 | 2533 |
| 24 | CRAWFORD | 18569 | 9652 | 8917 | 8354 | 563 |
| 25 | DALLAS | 24123 | 15018 | 9105 | 6813 | 2292 |
| 26 | DAVIS | 9199 | 3454 | 5745 | 4795 | 950 |
| 27 | DECATUR | 10539 | 5973 | 4566 | 3960 | 606 |
| 28 | DELAWARE | 18483 | 8534 | 9949 | 9038 | 911 |
| 29 | DES MOINES | 44605 | 36854 | 7751 | 4625 | 3126 |
| 30 | DICKINSON | 12574 | 7563 | 5011 | 3666 | 1345 |
| 31 | DUBUQUE | 80048 | 64130 | 15918 | 9461 | 6457 |
| 32 | EMMET | 14871 | 9934 | 4937 | 4315 | 622 |
| 33 | FAYETTE | 28581 | 16541 | 12040 | 10401 | 1639 |
| 34 | FLOYD | 21102 | 13578 | 7524 | 6483 | 1041 |
| 35 | FRANKLIN | 15472 | 7504 | 7968 | 7130 | 838 |
| 36 | FREMONT | 10282 | 5208 | 5074 | 3993 | 1081 |
| 37 | GREENE | 14379 | 7794 | 6585 | 6069 | 516 |
| 38 | GRUNDY | 14132 | 7075 | 7057 | 6225 | 832 |
| 39 | GUTHRIE | 13607 | 6654 | 6953 | 6330 | 623 |
| 40 | HAMILTON | 20032 | 12504 | 7528 | 6833 | 695 |
| 41 | HANCOCK | 14604 | 6651 | 7953 | 6979 | 974 |
| 42 | HARDIN | 22533 | 14369 | 8164 | 7138 | 1026 |
| 43 | HARRISON | 17600 | 9617 | 7983 | 6836 | 1147 |
| 44 | HENRY | 18187 | 11679 | 6508 | 5871 | 637 |

| | County Number and Name | Total County | Cities | Unincorporated areas | Rural Farm | Rural Non-farm |
|---|---|---|---|---|---|---|
| 45 | HOWARD | 12734 | 6037 | 6697 | 6155 | 542 |
| 46 | HUMBOLDT | 13156 | 7600 | 5556 | 5392 | 164 |
| 47 | IDA | 10269 | 5198 | 5071 | 4963 | 108 |
| 48 | IOWA | 16396 | 6044 | 10352 | 7508 | 2844 |
| 49 | JACKSON | 20754 | 11823 | 8931 | 7264 | 1667 |
| 50 | JASPER | 35282 | 23038 | 12244 | 8847 | 3397 |
| 51 | JEFFERSON | 15818 | 9526 | 6292 | 4640 | 1652 |
| 52 | JOHNSON | 53663 | 39821 | 13842 | 8118 | 5724 |
| 53 | JONES | 20693 | 11170 | 9523 | 7571 | 1952 |
| 54 | KEOKUK | 15492 | 7946 | 7546 | 6653 | 893 |
| 55 | KOSSUTH | 25314 | 11792 | 13522 | 11580 | 1942 |
| 56 | LEE | 44207 | 33964 | 10243 | 6225 | 4018 |
| 57 | LINN | 136899 | 114766 | 22133 | 10046 | 12087 |
| 58 | LOUISA | 10290 | 5200 | 5090 | 3839 | 1251 |
| 59 | LUCAS | 10923 | 6389 | 4534 | 3817 | 717 |
| 60 | LYON | 14468 | 6626 | 7842 | 7390 | 452 |
| 61 | MADISON | 12295 | 5670 | 6625 | 5464 | 1161 |
| 62 | MAHASKA | 23602 | 14685 | 8917 | 7560 | 1357 |
| 63 | MARION | 25886 | 16604 | 9282 | 6331 | 2951 |
| 64 | MARSHALL | 37984 | 27114 | 10870 | 7612 | 3258 |
| 65 | MILLS | 13050 | 7877 | 5173 | 4079 | 1094 |
| 66 | MITCHELL | 14043 | 6625 | 7418 | 6299 | 1119 |
| 67 | MONONA | 13916 | 7338 | 6578 | 5951 | 627 |
| 68 | MONROE | 10463 | 5433 | 5030 | 3798 | 1232 |
| 69 | MONTGOMERY | 14467 | 9318 | 5149 | 4544 | 605 |
| 70 | MUSCATINE | 33840 | 25742 | 8098 | 5134 | 2964 |
| 71 | O'BRIEN | 18840 | 11736 | 7104 | 7086 | 18 |
| 72 | OSCEOLA | 10064 | 4751 | 5313 | 4999 | 314 |
| 73 | PAGE | 21023 | 14109 | 6914 | 5495 | 1419 |
| 74 | PALO ALTO | 14736 | 7539 | 7197 | 6329 | 868 |
| 75 | PLYMOUTH | 23906 | 12168 | 11738 | 10115 | 1623 |
| 76 | POCAHONTAS | 14234 | 6836 | 7398 | 6805 | 593 |
| 77 | POLK | 266315 | 240375 | 25940 | 6678 | 19262 |
| 78 | POTTAWATTAMIE | 83102 | 65086 | 18016 | 10101 | 7915 |
| 79 | POWESHIEK | 19300 | 11475 | 7825 | 6785 | 1040 |
| 80 | RINGGOLD | 7910 | 3354 | 4556 | 4534 | 22 |
| 81 | SAC | 17007 | 9078 | 7929 | 6738 | 1191 |
| 82 | SCOTT | 119067 | 107239 | 11828 | 6490 | 5338 |
| 83 | SHELBY | 15825 | 7611 | 8214 | 7798 | 416 |
| 84 | SIOUX | 26375 | 14033 | 12342 | 10852 | 1490 |
| 85 | STORY | 49327 | 38779 | 10548 | 7214 | 3334 |
| 86 | TAMA | 21413 | 9759 | 11654 | 8837 | 2817 |
| 87 | TAYLOR | 10289 | 4872 | 5416 | 5279 | 137 |
| 88 | UNION | 13712 | 9475 | 4237 | 3895 | 342 |
| 89 | VAN BUREN | 9778 | 4276 | 5502 | 4560 | 942 |
| 90 | WAPELLO | 46126 | 37533 | 8593 | 5063 | 3530 |
| 91 | WARREN | 20829 | 12093 | 8736 | 6526 | 2210 |
| 92 | WASHINGTON | 19406 | 10691 | 8715 | 7127 | 1588 |
| 93 | WAYNE | 9800 | 4957 | 4843 | 4319 | 524 |
| 94 | WEBSTER | 47810 | 33991 | 13819 | 8238 | 5581 |
| 95 | WINNEBAGO | 13099 | 7159 | 5940 | 5532 | 408 |
| 96 | WINNESHIEK | 21651 | 9530 | 12121 | 10297 | 1824 |
| 97 | WOODBURY | 107849 | 96184 | 11665 | 9363 | 2302 |
| 98 | WORTH | 10259 | 4685 | 5574 | 5393 | 181 |
| 99 | WRIGHT | 19477 | 12139 | 7338 | 6720 | 618 |

APPENDIX A

Table 2

Population of Iowa Counties, 1970

| County Number and Name | | Population for: Total County | Cities | Unincorporated Areas | Rural Farm | Rural Non-farm |
|---|---|---|---|---|---|---|
| 1 | ADAIR | 9487 | 4641 | 4846 | 4220 | 626 |
| 2 | ADAMS | 6322 | 2711 | 3611 | 2584 | 1027 |
| 3 | ALLAMAKEE | 14968 | 7676 | 7292 | 5585 | 1707 |
| 4 | APPANOOSE | 15007 | 10102 | 4905 | 3075 | 1830 |
| 5 | AUDOBON | 9595 | 4512 | 5083 | 4364 | 719 |
| 6 | BENTON | 22885 | 13559 | 9326 | 7278 | 2048 |
| 7 | BLACK HAWK* | 132916 | 121754 | 11162 | 5512 | 5650 |
| 8 | BOONE | 26470 | 17555 | 8915 | 5519 | 3396 |
| 9 | BREMER | 22737 | 13841 | 8896 | 5655 | 3241 |
| 10 | BUCHANAN | 21762 | 11724 | 10038 | 7552 | 2486 |
| 11 | BUENA VISTA | 20693 | 14103 | 6590 | 5302 | 1288 |
| 12 | BUTLER | 16953 | 9290 | 7663 | 5862 | 1801 |
| 13 | CALHOUN | 14287 | 9639 | 5648 | 4353 | 1295 |
| 14 | CARROLL | 22912 | 15097 | 7815 | 7302 | 513 |
| 15 | CASS | 17007 | 11290 | 5717 | 4742 | 975 |
| 16 | CEDAR | 17655 | 9260 | 8395 | 6307 | 2088 |
| 17 | CERRO GORDO* | 49223 | 41465 | 7758 | 4199 | 3559 |
| 18 | CHEROKEE | 17269 | 10931 | 6338 | 4922 | 1416 |
| 19 | CHICKASAW | 14969 | 7597 | 7372 | 5663 | 1709 |
| 20 | CLARKE | 7581 | 3930 | 3651 | 2801 | 850 |
| 21 | CLAY | 18464 | 12816 | 5648 | 4361 | 1287 |
| 22 | CLAYTON | 20606 | 9543 | 11063 | 7998 | 3065 |
| 23 | CLINTON | 56749 | 46185 | 10564 | 7652 | 2912 |
| 24 | CRAWFORD | 19116 | 11213 | 7903 | 6942 | 961 |
| 25 | DALLAS | 26085 | 17155 | 8930 | 5373 | 3557 |
| 26 | DAVIS | 8207 | 3281 | 4926 | 3389 | 1537 |
| 27 | DECATUR | 9737 | 6181 | 3556 | 3016 | 540 |
| 28 | DELAWARE | 18770 | 8839 | 9931 | 7666 | 2265 |
| 29 | DES MOINES | 46982 | 38138 | 8844 | 3040 | 5804 |
| 30 | DICKINSON * | 12565 | 8277 | 4288 | 3068 | 1220 |
| 31 | DUBUQUE | 90609 | 72232 | 18377 | 8978 | 9399 |
| 32 | EMMET | 14009 | 10153 | 3856 | 3226 | 630 |
| 33 | FAYETTE | 26898 | 16154 | 10744 | 7925 | 2819 |
| 34 | FLOYD | 19860 | 12877 | 6983 | 5223 | 1760 |
| 35 | FRANKLIN | 13255 | 6981 | 6274 | 4886 | 1388 |
| 36 | FREMONT | 9282 | 5046 | 4236 | 3057 | 1179 |
| 37 | GREENE | 12716 | 7768 | 4948 | 3698 | 1250 |
| 38 | GRUNDY | 14119 | 7579 | 6540 | 5582 | 958 |
| 39 | GUTHRIE | 12243 | 6270 | 5973 | 4721 | 1252 |
| 40 | HAMILTON | 18383 | 12401 | 5982 | 5219 | 763 |
| 41 | HANCOCK | 13506 | 7014 | 6492 | 5648 | 844 |
| 42 | HARDIN | 22248 | 15184 | 7064 | 5605 | 1459 |
| 43 | HARRISON | 16240 | 9450 | 6790 | 4973 | 1817 |
| 44 | HENRY | 18114 | 11768 | 6346 | 4733 | 1613 |

| County Number | and Name | Total County | Cities | Unincorporated Areas | Rural Farm | Rural Non-farm |
|---|---|---|---|---|---|---|
| 45 | HOWARD | 11442 | 5909 | 5533 | 4818 | 715 |
| 46 | HUMBOLDT | 12519 | 7616 | 4903 | 4063 | 840 |
| 47 | IDA | 9283 | 5228 | 4055 | 3669 | 386 |
| 48 | IOWA* | 15419 | 6513 | 8906 | 5727 | 3179 |
| 49 | JACKSON | 20839 | 11993 | 8846 | 6107 | 2739 |
| 50 | JASPER | 35425 | 23782 | 11643 | 7100 | 4543 |
| 51 | JEFFERSON | 15774 | 10086 | 5688 | 3676 | 2012 |
| 52 | JOHNSON | 72127 | 59014 | 13113 | 7203 | 5910 |
| 53 | JONES | 19868 | 11208 | 8660 | 5621 | 3039 |
| 54 | KEOKUK | 13943 | 7561 | 6382 | 5343 | 1039 |
| 55 | KOSSUTH | 22937 | 11841 | 11096 | 9618 | 1478 |
| 56 | LEE * | 42996 | 32106 | 10890 | 4631 | 6259 |
| 57 | LINN | 163213 | 143034 | 20179 | 8000 | 12179 |
| 58 | LOUISA | 10682 | 5679 | 5003 | 3009 | 1994 |
| 59 | LUCAS | 10163 | 6224 | 3939 | 3158 | 781 |
| 60 | LYON | 13340 | 6491 | 6849 | 6184 | 665 |
| 61 | MADISON | 11558 | 5923 | 5635 | 4157 | 1478 |
| 62 | MAHASKA | 22177 | 14227 | 7950 | 5850 | 2100 |
| 63 | MARION | 26352 | 18119 | 8233 | 4597 | 3636 |
| 64 | MARSHALL | 41076 | 31419 | 9657 | 5673 | 3984 |
| 65 | MILLS | 11832 | 7389 | 4443 | 3190 | 1253 |
| 66 | MITCHELL | 13108 | 6622 | 6486 | 5273 | 1213 |
| 67 | MONONA | 12069 | 7063 | 5006 | 3761 | 1245 |
| 68 | MONROE | 9357 | 4990 | 4367 | 3134 | 1233 |
| 69 | MONTGOMERY | 12781 | 8797 | 3984 | 3022 | 962 |
| 70 | MUSCATINE * | 37181 | 28323 | 8858 | 3899 | 4959 |
| 71 | O'BRIEN | 17522 | 11215 | 6307 | 5466 | 841 |
| 72 | OSCEOLA | 8555 | 4297 | 4258 | 3687 | 571 |
| 73 | PAGE | 18537 | 13529 | 5008 | 4361 | 647 |
| 74 | PALO ALTO | 13289 | 7577 | 5712 | 4503 | 1209 |
| 75 | PLYMOUTH | 24322 | 13800 | 10522 | 8664 | 1858 |
| 76 | POCAHONTAS | 12793 | 6947 | 5846 | 4836 | 960 |
| 77 | POLK * | 286130 | 261722 | 24408 | 4773 | 19635 |
| 78 | POTTAWATTAMIE | 86991 | 72002 | 14989 | 8041 | 6948 |
| 79 | POWESHIEK | 18803 | 12337 | 6466 | 5200 | 1266 |
| 80 | RINGGOLD | 6373 | 3016 | 3357 | 3096 | 261 |
| 81 | SAC | 15573 | 9108 | 6465 | 5410 | 1055 |
| 82 | SCOTT | 142687 | 131046 | 11641 | 5869 | 5772 |
| 83 | SHELBY | 15528 | 8404 | 7124 | 6020 | 1104 |
| 84 | SIOUX | 27996 | 17017 | 10979 | 9572 | 1407 |
| 85 | STORY | 62783 | 53520 | 9263 | 5129 | 4134 |
| 86 | TAMA | 20147 | 9538 | 10609 | 6837 | 3772 |
| 87 | TAYLOR | 8790 | 4687 | 4103 | 3851 | 252 |
| 88 | UNION | 13557 | 9940 | 3617 | 2893 | 724 |
| 89 | VAN BUREN | 8643 | 4033 | 4610 | 3161 | 1449 |
| 90 | WAPELLO* | 42149 | 33674 | 8475 | 3990 | 4485 |
| 91 | WARREN | 27432 | 15800 | 11632 | 5613 | 6019 |
| 92 | WASHINGTON | 18967 | 11127 | 7840 | 4997 | 2843 |
| 93 | WAYNE | 8405 | 4720 | 3685 | 3173 | 512 |
| 94 | WEBSTER | 48391 | 37234 | 11157 | 6229 | 4928 |
| 95 | WINNEBAGO | 12990 | 8196 | 4794 | 3933 | 861 |
| 96 | WINNISHIEK* | 21758 | 11725 | 10033 | 8182 | 1851 |
| 97 | WOODBURY | 103052 | 93540 | 9512 | 6813 | 2699 |
| 98 | WORTH | 8984 | 4636 | 4348 | 3588 | 760 |
| 99 | WRIGHT | 17294 | 11711 | 5583 | 5105 | 478 |

APPENDIX A

Table 3

Estimated Population of Iowa Counties, 1976

| County Number and Name | | Population for: Total County | Total Cities | Large Cities | Small Cities | Unincorporated Areas | Farm | Rural Non-farm |
|---|---|---|---|---|---|---|---|---|
| 1 | ADAIR | 9422 | 4678 | 0 | 4678 | 4744 | 4386 | 358 |
| 2 | ADAMS | 5893 | 2448 | 0 | 2448 | 3445 | 2924 | 521 |
| 3 | ALLAMAKEE | 15246 | 7614 | 3659 | 3955 | 7632 | 4488 | 3144 |
| 4 | APPANOOSE | 14957 | 9820 | 6231 | 3589 | 5137 | 4284 | 853 |
| 5 | AUDOBON | 9000 | 4082 | 2597 | 1485 | 4918 | 3672 | 1246 |
| 6 | BENTON | 23358 | 13746 | 7572 | 6174 | 9612 | 5644 | 3968 |
| 7 | BLACK HAWK | 135612 | 125044 | 117483 | 7561 | 10568 | 5304 | 5264 |
| 8 | BOONE | 26132 | 17266 | 12342 | 4924 | 8866 | 4692 | 4174 |
| 9 | BREMER | 24010 | 14419 | 7373 | 7046 | 9591 | 4930 | 4661 |
| 10 | BUCHANAN | 22531 | 12125 | 6035 | 6090 | 10406 | 5678 | 4728 |
| 11 | BUENA VISTA | 20413 | 14099 | 8589 | 5510 | 6314 | 4692 | 1622 |
| 12 | BUTLER | 17152 | 9347 | 0 | 9347 | 7805 | 5712 | 2093 |
| 13 | CALHOUN | 13753 | 8142 | 0 | 8142 | 5611 | 4318 | 1293 |
| 14 | CARROLL | 23211 | 15490 | 9221 | 6269 | 7721 | 5032 | 2689 |
| 15 | CASS | 16764 | 11093 | 7323 | 3770 | 5671 | 4284 | 1387 |
| 16 | CEDAR | 17562 | 9383 | 2816 | 6567 | 8179 | 4964 | 3215 |
| 17 | CERRO GORDO | 49445 | 40544 | 37300 | 3244 | 7901 | 3910 | 3991 |
| 18 | CHEROKEE | 16300 | 10205 | 6649 | 3556 | 6095 | 4420 | 1675 |
| 19 | CHICKASAW | 15302 | 7639 | 3631 | 4008 | 7663 | 4386 | 3277 |
| 20 | CLARKE | 7873 | 4120 | 3404 | 716 | 3753 | 2618 | 1135 |
| 21 | CLAY | 19006 | 13727 | 10988 | 2739 | 5279 | 3842 | 1437 |
| 22 | CLAYTON | 20611 | 10126 | 0 | 10126 | 10485 | 6970 | 3515 |
| 23 | CLINTON | 57782 | 46969 | 42456 | 4513 | 10813 | 6256 | 4557 |
| 24 | CRAWFORD | 18539 | 10684 | 6152 | 4532 | 7855 | 6086 | 1769 |
| 25 | DALLAS | 27453 | 18102 | 9248 | 8854 | 9351 | 4556 | 4795 |

Appendix A, Table 3 continued

| County Name and Number | | Total County | Total Cities | Large Cities | Small Cities | Unincorporated Areas | Farm | Rural Non-Farm |
|---|---|---|---|---|---|---|---|---|
| 26 | DAVIS | 8539 | 3181 | 2596 | 585 | 5358 | 4488 | 870 |
| 27 | DECATUR | 9784 | 6186 | 2648 | 3538 | 3598 | 3094 | 504 |
| 28 | DELAWARE | 19256 | 8779 | 4986 | 3792 | 10478 | 5644 | 4834 |
| 29 | DES MOINES | 45213 | 35713 | 32667 | 3046 | 9500 | 3094 | 6406 |
| 30 | DICKINSON | 13907 | 9256 | 3440 | 5816 | 4651 | 2482 | 2169 |
| 31 | DUBUQUE | 95232 | 73474 | 65358 | 8116 | 21758 | 6460 | 15298 |
| 32 | EMMET | 13663 | 9743 | 7679 | 2064 | 3920 | 2686 | 1234 |
| 33 | FAYETTE | 25860 | 15469 | 10416 | 5053 | 10391 | 6902 | 3489 |
| 34 | FLOYD | 20170 | 12772 | 9023 | 3749 | 7398 | 4284 | 3114 |
| 35 | FRANKLIN | 13204 | 7048 | 4474 | 2574 | 6156 | 4488 | 1668 |
| 36 | FREMONT | 9114 | 5026 | 0 | 5026 | 4088 | 2992 | 1096 |
| 37 | GREENE | 12102 | 7578 | 4721 | 2857 | 4524 | 3944 | 580 |
| 38 | GRUNDY | 14063 | 8029 | 2673 | 5356 | 6034 | 4420 | 1614 |
| 39 | GUTHRIE | 12240 | 6433 | 0 | 6433 | 5807 | 4352 | 1455 |
| 40 | HAMILTON | 17899 | 12133 | 8254 | 3879 | 5766 | 4658 | 1108 |
| 41 | HANCOCK | 13487 | 5326 | 354 | 4972 | 8161 | 4692 | 3469 |
| 42 | HARDIN | 21936 | 14952 | 9501 | 5451 | 6984 | 4454 | 2530 |
| 43 | HARRISON | 16452 | 9371 | 3502 | 5869 | 7081 | 4760 | 2321 |
| 44 | HENRY | 17682 | 11317 | 6616 | 4701 | 6365 | 3808 | 2557 |
| 45 | HOWARD | 11381 | 5694 | 3846 | 1848 | 5687 | 4046 | 1641 |
| 46 | HUMBOLDT | 12597 | 7931 | 4592 | 3339 | 4666 | 3230 | 1436 |
| 47 | IDA | 8888 | 4791 | 0 | 4791 | 4097 | 3366 | 731 |
| 48 | IOWA | 15312 | 6624 | 0 | 6624 | 8688 | 4590 | 4098 |
| 49 | JACKSON | 22047 | 12449 | 5838 | 6611 | 9598 | 5644 | 3954 |
| 50 | JASPER | 36503 | 24024 | 15598 | 8426 | 12479 | 5916 | 6563 |
| 51 | JEFFERSON | 14798 | 9041 | 7718 | 1323 | 5757 | 4012 | 1745 |
| 52 | JOHNSON | 76987 | 62769 | 55448 | 7321 | 14218 | 5372 | 8846 |
| 53 | JONES | 19986 | 11373 | 8096 | 3277 | 8613 | 5304 | 3309 |
| 54 | KEOKUK | 13310 | 7015 | 0 | 7015 | 6295 | 4454 | 1841 |
| 55 | KOSSUTH | 22713 | 12020 | 6361 | 5659 | 10693 | 7378 | 3315 |
| 56 | LEE | 42060 | 30550 | 27345 | 3205 | 11510 | 4454 | 7056 |

Appendix A, Table 3 Continued

| County Number and Name | | Total County | Total Cities | Large Cities | Small Cities | Unincorporated Areas | Farm | Rural Non-farm |
|---|---|---|---|---|---|---|---|---|
| 57 | LINN | 167320 | 144865 | 135201 | 9664 | 22455 | 6528 | 15927 |
| 58 | LOUISA | 11054 | 5669 | 0 | 5669 | 5385 | 2754 | 2631 |
| 59 | LUCAS | 10086 | 5975 | 4821 | 1154 | 4111 | 3366 | 745 |
| 60 | LYON | 13274 | 6580 | 2697 | 3883 | 6694 | 5168 | 1526 |
| 61 | MADISON | 12060 | 6205 | 3795 | 2410 | 5855 | 4896 | 959 |
| 62 | MAHASKA | 21815 | 13719 | 10585 | 3134 | 8096 | 5168 | 2928 |
| 63 | MARION | 27443 | 18574 | 14720 | 3854 | 8869 | 4760 | 4109 |
| 64 | MARSHALL | 42608 | 33049 | 27184 | 5865 | 9559 | 4692 | 4867 |
| 65 | MILLS | 12612 | 7839 | 4939 | 2900 | 4773 | 2890 | 1883 |
| 66 | MITCHELL | 12718 | 6516 | 3664 | 2852 | 6202 | 3944 | 2258 |
| 67 | MONONA | 11692 | 7114 | 3188 | 3926 | 4578 | 3808 | 770 |
| 68 | MONROE | 9304 | 4681 | 3842 | 839 | 4623 | 3502 | 1121 |
| 69 | MONTGOMERY | 12857 | 9194 | 6387 | 2807 | 3663 | 3162 | 501 |
| 70 | MUSCATINE | 39269 | 29612 | 26059 | 3553 | 9657 | 3672 | 5985 |
| 71 | O'BRIEN | 17377 | 10946 | 4552 | 6394 | 6431 | 4658 | 1773 |
| 72 | OSCEOLA | 8149 | 4328 | 2919 | 1409 | 3821 | 3094 | 727 |
| 73 | PAGE | 18666 | 13849 | 11564 | 2285 | 4817 | 4216 | 601 |
| 74 | PALO ALTO | 13248 | 7838 | 4307 | 3531 | 5410 | 3910 | 1500 |
| 75 | PLYMOUTH | 24226 | 13671 | 7991 | 5680 | 10555 | 7004 | 3551 |
| 76 | POCAHONTAS | 11793 | 6481 | 0 | 6481 | 5312 | 4250 | 1062 |
| 77 | POLK | 301265 | 274891 | 266207 | 8684 | 26374 | 5032 | 21342 |
| 78 | POTTAWATTAMIE | 86441 | 70233 | 61965 | 8268 | 16208 | 7616 | 8592 |
| 79 | POWESHIEK | 19438 | 12805 | 8729 | 4076 | 6633 | 4624 | 2009 |
| 80 | RINGGOLD | 6146 | 2943 | 0 | 2943 | 3203 | 3162 | 41 |
| 81 | SAC | 14908 | 8709 | 3061 | 5648 | 6199 | 4284 | 1915 |
| 82 | SCOTT | 152322 | 139811 | 132296 | 7515 | 12511 | 4046 | 8465 |
| 83 | SHELBY | 15233 | 8541 | 5250 | 3291 | 6692 | 4692 | 2000 |
| 84 | SIOUX | 29206 | 18284 | 10741 | 7543 | 10922 | 7174 | 3748 |
| 85 | STORY | 68868 | 59925 | 51912 | 8013 | 8943 | 4284 | 4659 |
| 86 | TAMA | 19614 | 11022 | 3029 | 7993 | 8592 | 6222 | 2370 |
| 87 | TAYLOR | 8101 | 4144 | 0 | 4144 | 3957 | 3910 | 47 |
| 88 | UNION | 13144 | 9532 | 7894 | 1638 | 3612 | 2686 | 926 |
| 89 | VAN BUREN | 8353 | 3889 | 0 | 3889 | 4464 | 3842 | 622 |
| 90 | WAPELLO | 39791 | 30766 | 27204 | 3562 | 9025 | 5066 | 3959 |
| 91 | WARREN | 32171 | 18625 | 12677 | 5948 | 13546 | 5236 | 8310 |
| 92 | WASHINGTON | 18812 | 11129 | 5903 | 5226 | 7683 | 4760 | 2923 |
| 93 | WAYNE | 8221 | 4729 | 0 | 4729 | 3492 | 3196 | 296 |
| 94 | WEBSTER | 47319 | 36333 | 30269 | 6064 | 10986 | 4930 | 6056 |
| 95 | WINNEBAGO | 13624 | 8502 | 4218 | 4284 | 5122 | 3292 | 1830 |
| 96 | WINNISHIEK | 21671 | 10435 | 7411 | 3024 | 11236 | 6732 | 4504 |
| 97 | WOODBURY | 103686 | 94319 | 85495 | 8823 | 9368 | 7106 | 2262 |
| 98 | WORTH | 8757 | 4560 | 0 | 4560 | 4197 | 3128 | 1069 |
| 99 | WRIGHT | 16731 | 11417 | 7185 | 4232 | 5314 | 4216 | 1098 |

# APPENDIX A

## NOTES

### Table Notes

* The 1970 city population includes those residing in unincorporated areas in 1970 which were annexed by a city between 1970 and 1976.

### Definitions

City population: Population residing within all incorporated places in the county.

Unincorporated population: Population residing in all unincorporated areas of the county.

Large city population: Population residing within incorporated places with a 1976 population exceeding 2500.

Small city population: Population residing within incorporated places with a 1976 population of 2500 or less.

Farm: A place of ten acres or more producing at least $50 gross income from the sale of agricultural products, or a place of less than ten acres if farm income amounted to $250 or more.

Rural farm population (1960 & 1970): Population residing on farms in the unincorporated area of the county (excluding urbanized areas) and in incorporated places of 2500 or less.

Farm population (1976): The total population residing on farms anywhere in the county.

Rural non-farm population: See the note on the method for calculating the rural non-farm population.

### Calculation of Rural Non-farm Population

The 1960 and 1970 rural non-farm population was calculated from published U.S. census data as follows:

(1) The population of all incorporated places in the county was summed to arrive at total city population.

(2) Total city population was subtracted from total county population to arrive at the population of unincorporated areas.

(3) From unincorporated population was subtracted the census figure for "rural farm population". The result is an estimate of the rural (unincorporated) non-farm population.

The estimates for rural non-farm population have a downward bias (that is, they are somewhat too low) due to the census definition of "rural farm". The census defines "rural" as the area including incorporated places of 2500 population or less plus the unincorporated area of the county, excluding densely populated unincorporated areas on the fringes of larger cities. The latter areas are included in the population of "urbanized areas". The margin of error lies in the fact that farm persons residing within incorporated places of 2500 or less will be counted both as part of the city population and as part of the "rural farm" population. These farm persons are therefore subtracted twice in arriving at the non-farm population figures. In other words, to arrive at more accurate figures for the rural non-farm population one would have to add back in an estimate of the farm population residing in cities of 2500 or less. Unfortunately, census statistics provide no basis for making such an estimate.

Statistics on the number of farms or agricultural land within incorporated areas (derived from county assessors) are of little help since the definition of farm varies from the census definition. For Iowa property tax assessment purposes, a farm is defined on the basis of acreage alone (ten acres or more). The census defines "farm" more satisfactorily, on the basis of acres and income. That is, a farm is a place of ten acres or more producing at least $50 gross income from the sale of agricultural products, or a place of less than ten acres if farm sales totaled at least $250. Using the ten acre criterion alone, many suburban acreages will be counted as farms even though the residents are in no way engaged in farming. The number of such acreages is, evidently, substantial. When the ten-acre defintion is used instead of the census definition the number of farms is substantially higher and the number of non-farm residents substantially lower.

The 1976 rural non-farm population was calculated as follows:

(1) U.S. census estimates of the population of all incorporated places in the county were summed to arrive at total estimated city population.

(2) From the census estimate of the total county population was substracted total city population to arrive at unincorporated population.

(3) The estimated number of farms in the county (from Iowa Crop and Livestock Reporting Service data) was multiplied by 3.4, the statewide average number of persons per farm. The figure 3.4 was derived by dividing the estimated 1976 total farm population of the state (from the U.S. Census Survey of Education and Income) by the estimate for the statewide total number of farms.

(4) The county farm population figure derived in step three was substracted from the unincorporated population to arrive at the rural non-farm population.

The 1976 figures are less reliable than those for 1960 and 1970 for several reasons: (a) the county and city population figures are census estimates rather than actual counts; (b) the number of farms in each county is also an estimate; (c) the number of persons per farm may vary from one county to the next (though this is unlikely to be a significant source of error); (d) the farm population residing within incorporated areas, including those with population exceeding 2500, has been subtracted twice in arriving at rural non-farm population.

The first three sources of error are probably random. The larger the unit under consideration, the more likely it will be that such random errors cancel out. Population figures for the more sparsely populated counties are probably less reliable. For a county with a rural non-farm population of only a few hundred, the percentage error could be substantial. The fourth source of error imparts a downward bias to the rural non-farm population figures. It should be noted that this bias is stronger than for the earlier figures, since the 1976 farm population includes those living in cities of more than 2500 population whereas the 1960 and 1970 figures did not.

In making comparisons between 1970 and 1976, two things should be noted. First, the development of farmland within incorporated areas may reduce the "city" farm population, whereas annexation of rural areas will increase the number of farm persons living in incorporated areas. The net effect on the bias of our estimates is uncertain. One thing remains clear: the double-counting of "city farmers" biases the absolute figures for rural non-farm population, but not necessarily the percentage change. Second, to the extent that there is a significant number of farms within large cities, the growth rate of the rural non-farm population has a downward bias. That is, this population is underestimated by a larger factor for 1976 than for 1970. This does not, however, help explain the negative growth rates in a number of counties, primarily in the south, since these counties contain few cities larger than 2500.

It should be noted that on a statewide basis, the downward bias in the estimates of the rural non-farm population is quite small. In 1970, there were approximately 430,000 acres of agricultural land within incorporated places in Iowa, according to a study by James A. Gibson and John F. Timmons (Land Use Inventory and Projection Model with Applications to Iowa and its Subregions, Center for Agricultural and Rural Development, Iowa State University, 1978). Dividing this number by the average size of an Iowa farm in 1970 (237 acres), yields an estimate of 1815 farms. Multiplying this by the average 3.4 persons per farm yields an estimate of 6,171 farm persons residing in incorporated places in 1970. If this number were added to our estimate of the 1970 rural non-farm population (237,625), the latter number would increase only about 2.5%. The error could be substantially larger for certain counties, but statewide the downward bias appears to be trivial.

Data Sources

U.S. Department of Commerce, Bureau of the Census. 1960 Census of Population, Volume I, Characteristics of the Population, Part 17, Iowa, Table 91 (Washington, D.C.: U.S. Gov. Printing Office, 1963).

U.S. Department of Commerce, Bureau of the Census. 1970 Census of Population, Volume I, Characteristics of the Population, Part 17, Iowa, Table 9, 10 and 137 (Washington, D.C.: U.S. Gov. Printing Office, 1973).

U.S. Department of Commerce, Bureau of the Census. Photocopy of computer printout of 1976 Iowa population estimates, to be published by Census Bureau in early 1979 as part of the series: Current Population Reports: Population Estimates and Projections.

U.S. Department of Commerce, Bureau of the Census, Survey of Income and Education, 1976.

Iowa Crop and Livestock Reporting Service, Iowa Agricultural Statistics, for 1976 and 1977. (Available from Agricultural Statistician, Federal Building Room 855, Des Moines, Ia).

## APPENDIX B

### The Regression Models Employed and the Results

Multiple regression analysis (ordinary least squares) was used to estimate the effects of rural non-farm development on expenditures for county secondary roads and the county sheriff. Data was collected for each of the variables listed below for each Iowa county for 1970 and 1976.

XSHER__ = Total county expenditures for the Sheriff's office divided by the rural population (unincorporated areas plus places of 2500 or less).

EROAD__ = Total county disbursements from the secondary road fund.

XROAD__ = Total county disbursements from the secondary road fund divided by the population of unincorporated areas.

YRURL__ = Rural per capita income (census-defined income per capita in rural areas, including incorporated places with less than 2500 population).

YUNIN__ = Per capita income for unincorporated part of county .

SRNFR__ = Rural (unincorporated) non-farm population as a percentage of total population of rural areas.

SRNFU__ = Rural non-farm population as a percentage of total population of unincorporated areas.

PGROR__ = Percentage increase in rural population (1960 to 1970, or 1970 to 1976).

URB__ = A dummy variable equal to one if total city population in 1976 exceeded 15,000, equal to zero otherwise. By this definition there were 25 "urban" counties (URB = 1).

CRIME__ = Index of total crime in 1976 (crimes per 100,000 population).

PDENS__ = 1976 county population density (total county population divided by county land area in square miles).

PFARM__ = Total farm population.

PRNF__ = Total rural non-farm population.

PTOWN__ = Total population of incorporated areas.

AREA __ = County land area in square miles.

The results are displayed below in the form of equations, with the dependent variable on the left and the explanatory variables on the right. The estimated coefficient for each variable is shown with the standard deviation in parentheses below. Coefficients which are significantly different from zero at the 10% level or better are designated by a single *; at the 1% level or better, by a double **. The value of $R^2$ (proportion of total variation in the dependent variable explained by the right-hand variables in the equation) is also given.

(1) XSHER70 = -2.0 + .0010YRURL70
(.0005)*

+ 16.5 SRNFR70 - 10.3 PGROR70
(2.6)** (2.5)**

+ 1.3 URB
(.6)*

$R^2$ = .52

(2) XSHER76 = 1.9 + .0010 YRURL76
(.0011)

+ 21.1 SRNFR76 - 40.8 PGROR76
(10.1)* (19.5)*

+ 7.6 URB
(2.4) **

$R^2$ = .29

(3) CRIME = 1190 + 120.3 SRNFR76
(999)

+ 3399.7 PGROR76 + 7.4 PDENS
(1944.7)* (1.5)**

$R^2$ = .39

(4) XSHER76 = 1.2 + .00D8YRURL76
(.0010)

+ 17.2 SRNFR76 - 45.8 PGROR76
(10.3)* (19.7)*

+ .0014 CRIME + 7.6 URB
(.0009) (2.4)**

(5) EROAD70 = - 270,434 + 45.4 PFARM70
(16.0)**

+ 8.4 PRNF70 + 2.3 PTOWN70
(12.9) (1.0)*

+ 1667 AREA + 14.0 YRURL70
(217)** (50.4)

$R^2$ = .79

(6) EROAD76 = - 302,757 - 251.9 PFARM76
(105.0)*

+ 82.7 PRNF76 + 1.4 PTOWN76
(33.4)* (2.8)

+ 4363 AREA + 52.7 YRURL76
(961)** (81.1)

$R^2$ = .41

(7) XROAD70 = 161.5 - .0031 YRURL70
(.0085)

- 101.2 SRNFU70 - 139.7 PGROU70
(23.6)** (33.3)**

$R^2$ = .46

(8) XROAD76 = 261.2 + .0119 YUNIN76
(.0094)

- 270.4 SRNFU76 - 77.5 PGROU76
(66.4)** (164.9)

$R^2$ = .25

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